Ceramic Production and Distribution in the Southeastern Maya Periphery

Late Classic Painted Serving Vessels

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CHAPTER 1

INTRODUCTION

BACKGROUND AND THEORETICAL OVERVIEW

This study investigates a Late Classic polychrome ceramic found throughout the southeastern region of the Maya. The work seeks to make explicit and to test assumptions that have been made about this "trade ware." The research starts with the question of whether the ceramic material represents stylistic interaction or material exchange. Then, production considerations such as standardization and centralization are evaluated. Finally, distributional patterns and the context of consumption are considered. Thus, data on various aspects of economic organization are incorporated in an attempt to reconstruct the role of a specific material good in the economic system of a society.

An economic system has been defined as "the rules which integrate the use of natural resources and techniques and assure continuous co-operation in the provision of material goods...." (Dalton 1968:149) An economic system can be viewed from the focus of components such as subsistence, technology, and trade or from stages in its process such as procurement, production, distribution, and consumption.

Even though the various stages in the process must be coordinated for an economic system to function, they frequently are not integrated into a single archaeological study (Earle 1981:231). Research has tended to focus on one of the processes in the system, treating the others as incidental input or output. In general, archaeologists have emphasized distribution or exchange (both of raw materials and of finished products) in their concern with the economics of prehistoric societies. Reasons for the emphasis on distribution probably can be attributed to several factors: 1) exchange of all types is believed to be a critical aspect of social organization, both in terms of continuity and change, 2) evidence of material exchange can be discerned in the archaeological record, and 3) methods for determining foreign or imported goods have become more precise.

Many studies of exchange have concentrated on long-distance exchange (Andrews 1980; Berdan 1982; Frankenstein and Rowlands 1978; Lamberg-Karlovsky 1975; Pires-Ferreira 1976), although recently shorter range patterns of material interaction have been investigated:

-- Intra-site: Fry and Cox 1974; Fry 1979.

-- Inter-site but considered local: Rice 1976; Rands and Bishop 1980; Johnson 1973; Arnold 1978; Bishop, Rands and Harbottle 1982.

-- Intra-regional: Shepard 1965; Plog 1976; Lauer 1971; Fry 1980.

Production processes, on the other hand, have been examined to a much lesser degree. For one thing, at the present time they appear to be harder to study directly from the archaeological record. Production loci may be difficult to locate if the manufacturing process did not leave readily recognizable nonperishable detritus.

Lithic production has received more attention than has ceramic manufacture, possibly because debitage has been successfully used to evaluate production steps (Pires-Ferreira 1976; Ammerman and Andrefsky 1982). Ceramic production loci would be expected to produce evidence of firing mistakes in the form of wasters even if permanent kilns had not been used. However, such direct evidence is infrequently cited in the literature and does not appear to have been integrated into investigations of production organization.

Inferential methods for investigating production concerns are only beginning to receive attention (Rice 1981). Production most often has been investigated in terms of craft specialization, viewing this characteristic of the economic system as evidence of social complexity and interdependence.

In the case of both exchange and production, the emphasis of many studies has been on diachronic research where the purpose is to demonstrate increasing social complexity through increasing interdependence and contact:

> "From an ecological and evolutionary perspective, social stratification and economic specialization reflect the differential distribution of resources and the societal management of these resources." (Rice 1981:119; emphasis added)

> "Archaeologists have concentrated heavily on understanding the developmental mechanism of trade. They have, however, failed to understand in depth the structure of prehistoric trade at any given time." (Lamberg-Karlovsky 1975:346; emphasis added)

Synchronic analyses have been less frequent, with integrated treatment of more than one part of the economic system being very rare, indeed. Consequently, the approach in the current work is to integrate the study of the processes of production, distribution, and, to a lesser extent, consumption of a type of ceramic serving vessels during one identifiable time period. [1]

One aspect of production which is important for understanding economic organization is occupational specialization. Determination of production specialization comes from both primary and inferred evidence. Primary evidence consists of remains in the archaeological record directly associated with the processing or production activity -- workshops or specialized activity areas, tool kits, storage facilities. Inferred evidence is gained from an evaluation of the end product which exhibits a degree of craftsmanship or skill beyond that expected from nonspecialized producers.

In the Maya area there has been considerable reliance on inference in discussions of occupational specialization (Adams 1970; Haviland 1970). There are several reasons for this. First of all, much archaeological activity has been concentrated on public architecture located at the center of large Maya sites, not a likely locus for direct evidence of economic specialization. Second, Classic Maya settlement was not as urbanized as other complex societies. For example at Teotihuacan in highland Mexico, production was organized to the point where occupational barrios have been located with evidence of obsidian working, pottery making, and lapidary activities (Millon 1976). Without an urban residential pattern, the location of specialized production centers may be more easily overlooked, depending upon the specific survey and excavation strategies employed.

However, one extensive field project at Tikal, Guatemala, has provided some direct evidence of specialization. At this site a large number of residential buildings and house groups were investigated and data about economic specialization have emerged. For instance, Becker (1973a) discusses for the Classic period at Tikal at least six occupational specialities that are archaeologically identifiable -- flint and obsidian knappers, potters, woodworkers, dental workers; masons,

---

[1]The category "serving vessel"(Fry 1979:496) is being used because it does not presuppose a restriction in availability to a certain segment of the society nor does it assume characteristics of distribution. Other classifications of trade goods are given by Rathje et al 1978, Rice 1981, and Tourtellot and Sabloff 1972.

stucco and construction workers; stoneworkers or monument carvers.

One residential group (4H-1) in central Tikal produced larger quantities of certain types of ceramics than would have been expected for the size and location of the unit. One midden in this group yielded many specialized ceramic products: whistles -- 8 fragments and 2 whole examples; figurines -- 39 fragments and one whole example; figurine molds -- 2 fragments and 2 intact; censers -- 40 pieces; other -- "scores of reconstructable bowls, wall insert fragments, candlesticks, and decorated vessels, including three with miscellaneous texts" (ibid:399). The presence of a large pottery architectural mask usually associated only with the relatively affluent or on public buildings led Becker to conclude that this was a reflection of the occupation of the residents, not their wealth (ibid:400). Another pottery workshop has tentatively been identified in peripheral Tikal from a large sample of broken serving vessels and pottery drums, all showing a uniform style and paste (Fry 1979:495).

From the Tikal data, both Becker and Haviland (1974) conclude that the degree of economic specialization at this site had not reached the point where certain lineages confined their activities to a single craft. Nevertheless, there is a suggestion from the stoneworker/monument carver residential data (Haviland 1974:496) that there was family craft specialization over several generations.

Thus, in terms of the Classic period within the Maya area there is some direct, as well as inferential, evidence for specialization in the production of ceramic objects. It is believed that the ceramics under study were made by specialized producers and that this will be corroborated during the course of the analyses. However, the primary thrust of the work on production is to go beyond the recognition of production specialization to draw inferences about levels of organization and control in the production process.

Fry, in dealing with Late Classic Maya serving vessel exchange, describes a series of possible types of exchange. Then, for each exchange type he specifies how items produced by one center would be expected to pattern in their spatial distribution (ibid:497).

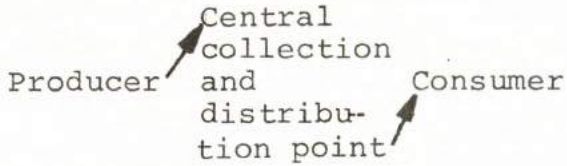
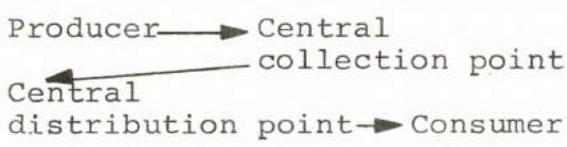
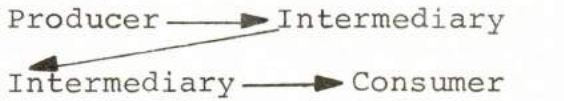
In turn, the type of exchange system in which the goods circulate affects the distribution path from producer to consumer. That is, the producer and consumer may deal directly or may be separated from one another by one or more intermediaries. Table 1 utilizes Fry's typology of exchange systems organized according to the producer-to-consumer path that would function in each system.

TABLE 1

Exchange System Typology Showing
Distribution Path From Producer To Consumer

Type of Exchange	Definition	Distribution Path
1. Supply zone	Single exchange between producer and consumer at place of production or use	Producer → Consumer
2. Down-the-line-exchange	Simple dyadic exchange; often structured in a complex stranded network of exchange relationships	Producer → Consumer Producer → Patron → Consumer
3. Simple centralized marketing	Exchange through a centrally located market	Producer → Consumer Producer → Intermediary → Consumer
4. Noncentralized marketing	Exchange through a series of smaller scale local markets with no overall systematization of the market system in a region	Producer → Consumer Producer → Intermediary → Consumer

TABLE 1 (continued)

Type of Exchange	Definition	Distribution Path
5. Simple centralized redistribution	Collection and redistribution of items by a centrally located person or institution	
6. Complex redistribution	Importation and redistribution of items at various levels of a hierarchical redistribution system	
7. Complex marketing	Exchange through a hierarchically organized series of local and regional markets of differing scale	

The distribution path is important because as the complexity of the economic activity increases so does the number of intermediaries between the producer and the consumer. Only two are shown in Types 6 and 7 but more can be conceived, depending on the specific levels of hierarchy present in the system. Thus, the distribution path can be conceptualized as direct, single intermediary, or multiple intermediary and is a reflection of the economic organization present in the system.

Several exchange systems are shown in Table 1 with alternate producer-consumer paths which reflect the possibility of differing social and economic organization. For example, down-the-line exchange could take place directly between pairs of producers and consumers. However, if it is among elites, the objects likely would be produced by specialists attached to the elite social group (Trigger 1974:100).

Alternate paths are also considered for both simple centralized marketing and noncentralized marketing. Reina and Hill (1978) have described how in contemporary Guatemala traditional pottery circulates in three types of markets (local, regional, and interregional) through three types of sellers: 1) vendors selling their own family's production in local markets or a nearby regional market, 2) middle traders (regatones) who maintain a permanent stall in a regional or interregional market, and 3) travelling merchants (comerciantes) who conduct wholesale business in the regional and interregional markets and retail business in local markets that are not pottery producing centers. Consumers purchase either in their local market or, if their municipio is not a pottery producing center, they may journey to a nearby local pottery producing market or to a regional market. Such trips occur only if needs are substantial enough to offset the additional time and transportation expense.

It is not suggested that this model can be directly applied to the prehistoric case being studied. However, it does seem probable that intermediaries -- merchants or middlemen of some type -- could have been active in either of these types of marketing systems, affecting certain production decisions.

Variations in production factors can be expected according to the type of exchange and the distribution path from producer to consumer:

1. The number of producing units and the capacity per unit

2. The total amount of vessels made that would be considered equivalent or appropriate for a given use

3. The degree of standardization desired/-achieved

4. The level of simplification desired/-achieved.

Thus, for a given distribution path, certain combinations of type and amount of product can be expected as well as different production organization.

Table 2 shows the expectations for production aspects according to the type of exchange system and distribution path that might be operating. Each of these production considerations will be discussed.

Number of producing units and the capacity per unit

Specialized pottery production can be divided into two broad groupings, elementary specialization and handicraft corporations:

1. Elementary specialization (Balfet 1965) or craft production (Rathje 1975) -- Two different production situations at this level of organization are:

   a. situations where individual artisans do all the steps in producing the finished pots from gathering the raw materials through the final firing. Other people may be called upon as a specific need arises to help with some of the more auxiliary aspects (such as transporting the raw materials or collecting fuel for firing), but this is done on an ad hoc basis with the potter being in control of the entire operation.

   b. situations where a small production unit, such as a nuclear family, divides up the steps in the pottery-production sequence with different members having specific responsibilities under the supervision of one individual, probably the one most skilled in the more complicated steps of shaping and decorating.

   Reina and Hill (1978:21) describe several contemporary pottery making villages in Guatemala where "assembly-line" techniques are used by family production units.

2. Handicraft corporations (Balfet 1965) or centralized workshops -- One of the important elements in this type of production situation which distinguishes the category

TABLE 2

Expectations For Various Aspects Of Specialized Ceramic Serving Vessel Production In Different Types Of Exchange Systems And Distribution Paths

Type of Exchange System/ Distribution Path	Number & Probable Type Of Producing Units	Total Amount Of Ceramics Made	Degree of Standardization Of Shape & Decoration	Degree of Simplification
1. Supply zone Producer → Consumer	many, single potter or ad hoc family unit	limited	limited; no central control	limited; could be some elaboration
2. Down-the-line Producer → Consumer	many, single potter	limited	limited; no central control	limited, a lot of elaboration
Producer → Patron Consumer	few, single potter or family unit	limited	limited; central control	
3. Simple centralized marketing Producer → Consumer Producer → Intermediary Consumer	moderate; family unit, perhaps organized as small workshops	medium	moderate; competitive control	moderate to high
4. Noncentralized marketing Producer → Consumer Producer → Intermediary Consumer	moderate; family unit, perhaps organized as small workshops	medium	moderate; could be high within a marketing area; low between areas; competitive control	moderate to high

TABLE 2 (continued)

Type of Exchange System/ Distribution Path	Number & Probable Type Of Producing Units	Total Amount Of Ceramics Made	Degree of Standardization Of Shape & Decoration	Degree of Simplification
5. Simple centralized redistribution Producer → Central collection and distribution point → Consumer	moderate; family unit, perhaps organized as small workshops	medium	high; central control	moderate to high
6. Complex redistribution Producer → Central collection Central distribution → Consumer	moderate; centralized workshops	large	high; strong central control; could be standardized differently for different areas	high
7. Complex marketing Producer → Intermediary Intermediary → Consumer	moderate; centralized workshops	large	as 6 but competitive control could be slightly less	high

> from elementary specialization is the corporate structure based on something other than an individual or family relationship. The specific organizational principle may vary according to the nature of the society in which it is placed. However, in general, numerous specialists are organized for the various steps in the production process.

The quantity of pottery that can be produced by these different types of units varies not only because of the involvement of varying numbers of people but also through efficiencies possible in larger scale production. Pottery making lends itself to task specialization or "assembly-line" procedures, so a workshop organized along task-specific lines could turn out more vessels than an equivalent number of potters working independently.

It is expected that craft production, either by single potters or family production units, would be the manner of organization for serving vessel manufacture until the exchange system reached the complex level where multiple intermediary distribution paths occurred. If the ceramics were being produced for entry into a complex redistribution or market system, it is probable that production would be organized into centralized workshops capable of substantial output under controlled conditions.

The number of producers under most exchange system conditions probably would be moderate. Serving vessel demand would not be as substantial as that for utilitarian vessels whose use in food preparation and storage leads to more frequent replacement needs. The exceptions would be: 1) in a supply zone system where many individual potters would supply small quantities, each to a limited number of consumers and 2) in a down-the-line exchange system where either many individual potterns, possibly part-time specialists, produced for their exchange partners or where few full-time specialists, working under direction, produced for elite exchange.

The number and type of production unit could also be influenced by the location and size of the raw material sources, particularly the clay. Nicklin (1979) presents a very thorough discussion of the varied strategies used by potters under different circumstances of clay availability. One result of the presence of sporadic clay distribution with a few major deposits can be the establishment of major specialized centers at the clay fields (ibid:443). Thus, production units can be affected by considerations of raw material procurement as well as exchange-based requirements.

the pieces moving directly from producer to consumer in these systems, there is no central control and no incentive for standardization. In terms of gift exchange items produced under elite auspices, the objective would likely be the opposite of standardization -- unique, one-of-a-kind items (Earle 1982a:8).

Incentives for standardization would come from different sources in the case of marketing and redistribution systems but would be stronger than in the simpler exchange systems. In the case of redistribution, the centrally located person or institution would want to have easily recognizable, equivalently valued serving vessels for distribution. In the case of marketing, the producers or middlemen intermediaries would want to be competitive with other vendors in the market, providing accepted shapes and decoration on their wares.

If the exchange system were complex, there could be different standards for different marketing or redistributive areas. Similarly, products in a noncentralized marketing system could show standardization within a market but more variability among markets if different production units supplied different markets without much competition per market.

Degree of simplification

As with standardization, when specialization is organized to produce sizable quantities of a product there is a tendency toward simplification. Simplification has an advantage in large-scale production of reducing the reliance on highly skilled craftsmen whose work capacity would dictate or curtail the possible output. Additionally, in general, a simplified article will require a lower investment in the production cost. (See Rathje 1975:416 concerning differences in cost control.) Simplification in pottery production is most likely to be visible in two aspects of the product: form and decoration. However the same caveat applies as was mentioned for standardization. There will be situations where the type of exchange precludes the cost effective measures of simplification and where elaboration will be required for "marketability." Elaboration would be expected, for example, in both types of down-the-line exchange and to a somewhat lesser extent in supply zone exchange. For other types of exchange, however, simplification would be expected.

The foregoing discussion demonstrates that the kind of product, the amount made, and the circumstances under which the ceramics were produced can all vary within the general category of specialized production. These will combine in different ways depending on the type of distribution path associated with a certain

Amount of vessels made

The amount of vessels produced will be affected by the number of producing units and their capacity but it is more directly determined by the demand for product and the scale of the exchange system. As Renfrew has stated "a high level of production by a number of craft specialists in a limited area cannot easily be sustained without a highly organized means of distributing the product and without a large constituency of customers. This can only be available either through a very high population density, generally in an urban society, or an efficient export trade." (1977b:9)

Thus, the scale of serving vessel production would probably be moderate unless the exchange system operated throughout a large region on a scale which probably would necessitate hierarchical organization.

Degree of standardization

One of the generally accepted corollaries of specialization is standardization. As various steps in the production process are repeated with regularity and frequency, the range of variation narrows and the results become more predictable. The result is a stronger relationship between producer and product (van der Leeuw 1980; Balfet 1965) with routinization of steps, incentives to efficiencies in methods, etc. Since work is done regularly, skill, as well as facility, is achieved so products may be of better quality technically than those of generalized production.

Standardization in the technological aspects -- selecting the raw materials, preparing the paste, constructing the vessels and firing -- probably will occur with specialization regardless of the specific exchange system into which the ceramics are channeled. (Incentives for standardization may vary according to competition and other factors, of course.) Other aspects, such as the actual shape (with its size and dimension characteristics) and the decoration will be directly affected by the specific type of exchange in which the ceramics will be operating and by the value level of the vessel group. If the items are intended for high value consumption, the goal would likely be to produce highly differentiated, distinctive appearing vessels. Thus, standardization in decoration and, to a lesser extent, shape would be incongruent with the marketing objective. On the other hand, if the pottery is more of a "middle class" commodity, then these features would be standardized in order to produce an easily recognizable product.

For instance, ceramics being made for supply zone and down-the-line exchange systems would not be expected to show much standardization. In the case of

the pieces moving directly from producer to consumer in these systems, there is no central control and no incentive for standardization. In terms of gift exchange items produced under elite auspices, the objective would likely be the opposite of standardization -- unique, one-of-a-kind items (Earle 1982a:8).

Incentives for standardization would come from different sources in the case of marketing and redistribution systems but would be stronger than in the simpler exchange systems. In the case of redistribution, the centrally located person or institution would want to have easily recognizable, equivalently valued serving vessels for distribution. In the case of marketing, the producers or middlemen intermediaries would want to be competitive with other vendors in the market, providing accepted shapes and decoration on their wares.

If the exchange system were complex, there could be different standards for different marketing or redistributive areas. Similarly, products in a noncentralized marketing system could show standardization within a market but more variability among markets if different production units supplied different markets without much competition per market.

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As with standardization, when specialization is organized to produce sizable quantities of a product there is a tendency toward simplification. Simplification has an advantage in large-scale production of reducing the reliance on highly skilled craftsmen whose work capacity would dictate or curtail the possible output. Additionally, in general, a simplified article will require a lower investment in the production cost. (See Rathje 1975:416 concerning differences in cost control.) Simplification in pottery production is most likely to be visible in two aspects of the product: form and decoration. However the same caveat applies as was mentioned for standardization. There will be situations where the type of exchange precludes the cost-effective measures of simplification and where elaboration will be required for "marketability." Elaboration would be expected, for example, in both types of down-the-line exchange and to a somewhat lesser extent in supply zone exchange. For other types of exchange, however, simplification would be expected.

The foregoing discussion demonstrates that the kind of product, the amount made, and the circumstances under which the ceramics were produced can all vary within the general category of specialized production. These will combine in different ways depending on the type of distribution path associated with a certain

exchange system. Combinations of the various production aspects can be used to specify the distribution path for the goods, from which it should be possible to predict the kind of exchange system through which they circulated. The prediction can then be evaluated through a study of the spatial distribution of the ceramics. (The procedure, of course, can be reversed with the exchange system specified and used to predict the production considerations.) In this manner, two key processes in the economic system -- production and distribution -- can be studied systematically with the findings for one process producing hypotheses about the other process. The chapters on production and distribution will use this orientation when dealing with the data relating to these processes.

Two points should be made about the orientation of the research:

1. Production and distribution are being studied from a synchronic point of view, within a specific time period, in order to understand the social organization and to gain knowledge about cultural integration during the particular era in the delineated geographic area. Frequently, exchange is looked upon as evidence of increasing social hierarchy and is emphasized for its communication role in processes of social change. Examining or explaining social change is not an objective of the present work.

2. Only one restricted category of goods -- painted ceramic serving vessels -- is being investigated. Broad inferences about exchange networks cannot be made with data from a single classification of material. Researchers have come to realize that different commodities and manufactured goods moved through different exchange systems and that even within a category, such as pottery, varied classes of vessels were subject to different distributional methods (cf. Fry and Cox 1974). In order to reconstruct the operation of an exchange network considerable data about a range of exchange goods are needed. The current work should be considered as potential input into such a large-scale analysis; it will provide a detailed understanding of one component being produced and distributed within the context of a complex society.

TEMPORAL AND SPATIAL FOCUS

The period under investigation is the Late Classic period (650 - 850 A.D.) in the Maya culture. This was the epoch of substantial growth and development throughout the entire Lowland area. It was a period of high population density, particularly around powerful civic centers. Intensified agriculture was practised using both terracing and irrigated raised fields (Adams 1982; Harrison and Turner 1978).

Societal organization was based on an extended family unit and residence probably was patrilocal (Haviland 1966b). Social stratification definitely was present although there is disagreement on how closed or inflexible the system was. There is agreement that each center was governed by a hereditary dynasty that held both religious and secular power. Below the ruling group were a number of different strata.

Hammond (1982:189-197) has recently set forth the most specific categorization of Late Classic Maya class structure, divided into seven levels:

1. Ruling family
2. Administrative bureaucracy which translated the ruler's general directives into actionable tasks and assigned them to specific executives
3. Executive bureaucracy which carried out the directives and operated at a local level, possibly associated with a high local social status
4. Intellectual specialists such as architects, priests, scribes, etc.
5. Craft specialists such as potters, sculptors, lapidaries, etc.
6. Unskilled laborers
7. Peasant farmers.

While Hammond's division is largely inferred, the scheme is logical and reflects the functional needs of a complex society.

Spatial organization consisted of a series of large centers with impressive public architecture surrounded by subordinate centers also with public buildings. These smaller centers must have functioned in an administrative capacity -- civic, religious, or economic -- to integrate outlying villages, hamlets, and farmsteads into the polity. Politically, each of these

large center-based units was independent; no overreaching state organization controlled all the Maya area. The level of political organization probably was equivalent to what Renfrew (1975) has called the Early State Module.

Rulership by site followed a pattern of patrilineal succession (Haviland 1977), although instances of disputed accession have been determined from hieroglyphic texts. Relationships between dynasties of different sites were maintained by marriage (Marcus 1976; Haviland 1977). The spatial extent of political control exercised by the various centers is unknown but currently "territories" are drawn according to the occurrence at smaller sites of the larger center's emblem glyph (Marcus 1976; Kelley 1976).

Economic contact was widespread throughout the area, operating at local, regional, and long-distance levels. Both perishable and imperishable commodities were circulated. Some of the commodities involved, based on archaeological evidence as well as by inference from postconquest documents included the following: perishables -- honey, cacao, feathers (including those of the quetzal bird), tobacco, cotton garments, marine products and shells, lime products, and salt; imperishables -- pottery (fine paste, polychrome, incensarios), stone vases, metal work, jade, obsidian, metates (lava and granite), and slaves (Hammond 1982: 225). Trade routes operated by sea around the coasts, between the coasts and inland, and in the interior (both overland and riverine).

The participation of the various political units in a widespread cultural tradition is attested to by shared patterns of monumental art, architecture, and the stela complex, as well as by the hieroglyphic writing and calendric systems (Nicholson 1967). These characteristics indicate regular communication and interaction over a considerable spatial area.

The Maya territory traditionally has been divided into several regions according to both topographical and cultural manifestations. (See Henderson 1981:48-59 for a recent discussion of these divisions.) The southeastern periphery topographically is an intermediate zone between the heavy rain forest of the central Peten lowlands and the highlands. Culturally, it contains the most southerly expression of the full Maya complex of corbel vaulted architecture, Long Count calendrics, and the stela-altar complex. The Late Classic period in the southeast Maya area was the time of flourishing centers like Copan and Quirigua. Available data suggest considerable communication and trade during this period both within this general region and beyond.

Three different subregions of the southeastern Maya periphery are emphasized in the current investigation -- the Rio Copan zone in western Honduras, the middle and lower Motagua Valley in Guatemala, and western El Salvador. (See Figure 1.) The following sections will provide a geographic and geologic perspective of the environments for each zone and will describe the major archaeological sites in each subregion.

Natural Environment

Rio Copan Zone (Western Honduras)

The ruins of Copan lie in the western part of Honduras within a small valley carved by the Copan River. The Copan River flows westward into the Motagua drainage through the Central American highlands, some of the most rugged terrain of the region. The river forms a series of small valleys or pockets from west to east: the Copan Valley, Santa Rita, El Jaral, the lower Rio Amarillo, and the upper Rio Amerillo. Turner et al. (n.d.) have defined four principal physiographic zones of these valleys: 1) the floodplain, 2) the river terraces, 3) the foothills, and 4) the ridge slopes. The pockets of Santa Rita, El Jaral, and the lower Rio Amarillo are all extremely small and when combined make up an area of less than four sq. km. of valley bottomlands. The upper Rio Amarillo forms a much larger pocket with almost nine sq. km. of bottomlands (floodplain and river terraces). The main ruins of Rio Amarillo are located along the southern edge of the bottomlands.

The westernmost pocket, the Copan Valley, is the largest along the Copan River system. The entire valley measures about 10 to 12 km. east-west and averages about 2.5 km. north-south, creating an area of between 25 and 30 sq. km. Approximately half of this area consists of well-watered bottomlands, extremely good for agriculture. The floodplain, of varying width, is a fairly small part of the bottomlands. Terraces ranging in height from 5 to 10 meters above the river, dominate the bottomlands. Foothills gradually rise upward from the river terraces and merge into steep, rugged upper ridge slopes.

Middle and Lower Motagua Valley (Guatemala)

The Motagua river and its tributaries provide the major drainage from the Guatemalan highlands eastwards, emptying into the Caribbean (Gulf of Amatique). For most of its length the valley coincides with the Motagua fault, a major rift forming the margin of two continental plates (see Plafker 1976). The mountainous margins of the valley are composed of a great variety of geological formations, mostly of metamorphic (serpentine and schist/gneiss with quartz, mica, and feldspars) and sedementary (sandstones and, near the Caribbean, limestone) origins (West 1964). In the lower

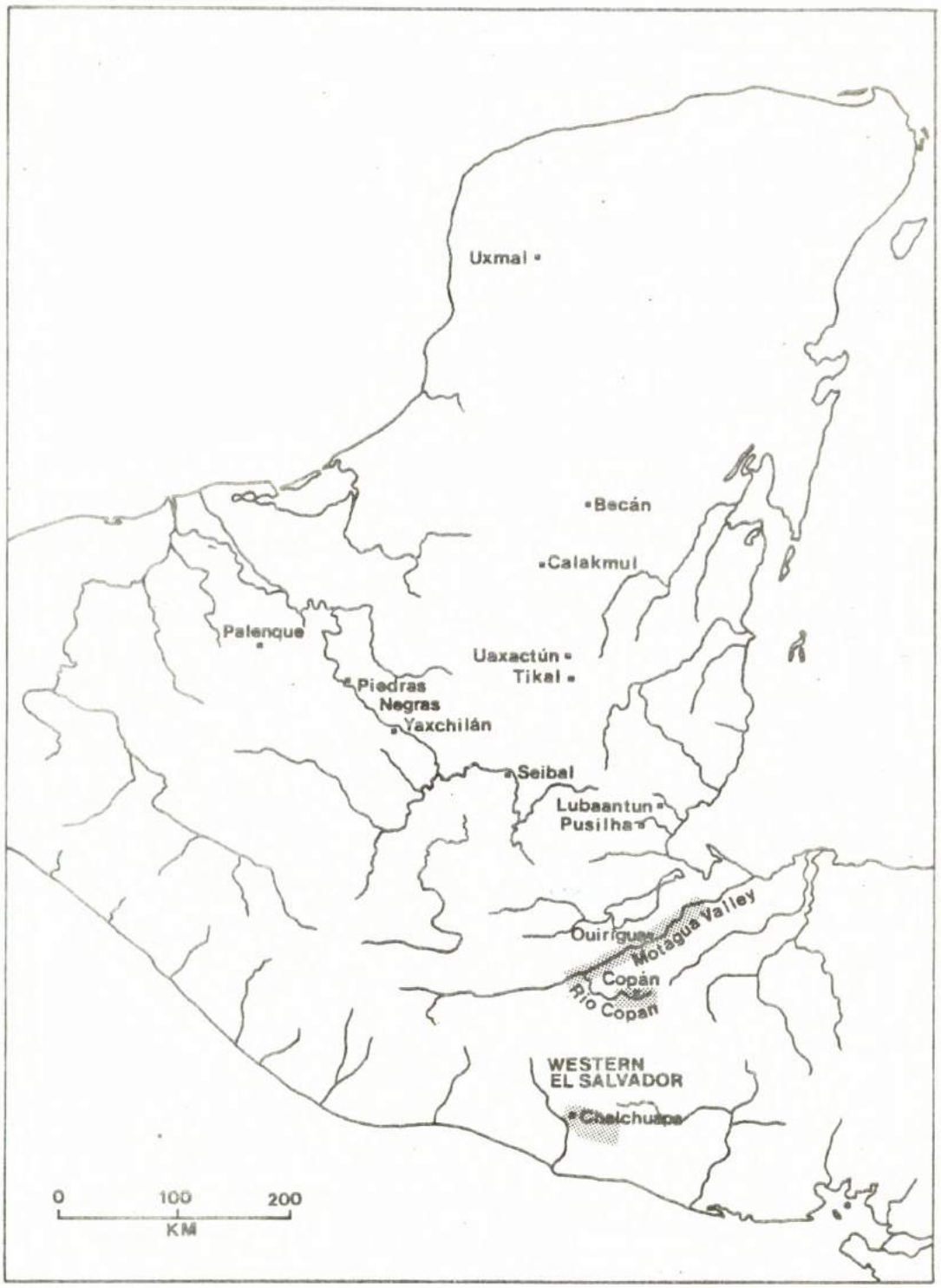

Figure 1: Sub-Regions of The Southeastern Maya Periphery Emphasized in The Research

Motagua valley, defined by an active floodplain that begins just west of Quirigua, there are narrow bands of igneous (rhyolite) materials. Volcanic deposits overlie many of these deposits, especially in the Middle portion of the valley.

Western and West-Central El Salvador

The country can be divided into four major topographic units based on structure, age, and origin (Daugherty 1969): coastal plain, coastal mountains, interior structural trough, and northern mountains. Of particular interest to this project is the interior trough which is ringed with Late Pleistocene and Recent volcanoes along its southern edge and has occasional earlier volcanoes along its northern edge.

Chalchuapa in western El Salvador, situated in this trough, is in a broad basin drained by the Rio Paz and its tributaries, some 700 meters above sea level. Climate and environmental conditions are best described as transistional between lowland (coastal) and highland types (Vivo Escoto 1964). The entire region is dominated by recent volcanic activity (West 1964). The Sierra Lamatepeque y Apaneca, including the extinct volcano Santa Ana and the recently active cone of Izalco, bounds the valley of the Rio Paz to the southeast. Overlooking Chalchuapa to the northwest is the dissected cone of Chingo volcano. The valley floor is composed of recent volcanic and alluvial deposits, revealed by the downcutting of the Rio Pampe immediately north of the site.

The Zapotitan Valley, in the west-central part of El Salvador, spreads between the Santa Ana and San Salvador volcanic complexes. It is drained by the Rio Sucio and the southern end is formed by the coastal mountains. The basin is a remnant of the interior structural trough, hemmed in on the east and west by geologically recent volcanic activity which created the interior mountains. This zone, having been formed by the erosion and deposition of mountain sediments in the restricted area, is rich and fertile.

Cultural Settings

Rio Copan Zone

Copan Valley. The ancient Maya site of Copan has been the center of archaeological research for the past 90 years. Expeditions led by the Peabody Museum, Harvard University in the 1890's (Gordon 1896), and the Carnegie Institution of Washington in the 1930s and 1940s (Morley 1920; Longyear 1952) focused primarily upon the monuments and major architecture within Copan's central zone. However, several projects over the past eight years have begun to examine the entire Copan valley as a single settlement area.

The main center of Copan is located on a river terrace within the central area of the Copan valley. It consists of a major acropolis area, towering upwards of 100 feet into the air, and a large open expanse of plaza studded with various carved monuments. Extremely dense settlement extends to the east into the Sepulturas section of the valley and to the south-southwest into the Bosque section. These are apparently elite residential areas. Large, multiple plaza groups are located throughout these two areas.

The northeast section of the valley, comprised of mostly low foothills, is also fairly densely occupied but with a greater number of smaller groups than in the bottomland areas mentioned previously. Scattered household groups are found within the remaining portions of the valley. It is clear that, although there is occupation outside the valley area itself, the steep upper slopes which demarcate the valley proper also demarcate the main focus of ancient settlement.

There is evidence of some sort of occupation within the valley which extends as far back in time as the Preclassic. However, it is hard to pinpoint the extent of this early occupation. The earliest monument, recovered by the Proyecto Arqueologico Copan, dates to approximately 8.19.0.0.0 - 9.0.0.0.0 (416-435 A.D.) At this time, settlement seems to have been concentrated at several points, primarily within the bottomlands. One family, located at the site of the present main ruins, was able to somehow consolidate power within its own hands and found the lineage which controlled Copan until its collapse around 800 A.D.

Settlement become more extensive during the Late Acbi and Cueva[2] phases. However, it is particularly around the time of the end of the Cueva phase and beginning of the Coner phase (marked by the appearance of Copador at Copan) when there is a population explosion within the valley. Almost all sections of the valley are occupied and the central areas are built up with a concentrated population.

Rio Amarillo.[3] This part of the zone has been less thoroughly investigated than the Copan Valley. Nevertheless, it appears to have sustained a sizable population at least during the Cueva and Coner phases. The Rio Amarillo site consists of several large plaza

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[2]Appendix A presents ceramic group names and their equivalences for sequences at Copan, Quirigua, and Chalchuapa.

[3]This site has also been referred to by the name La Canteada.

groups with architectural sculpture and carved altars. While the nature of its relationship with Copan has not been precisely established, it seems probable that the site functioned as a secondary center in the social hierarchy of the Coner phase of occupation. The ceramic assemblage, as presently known, contains the major components of the Copan valley sequence.

Middle and Lower Motagua Valley

San Agustin Acasaguastlan. This archaeological zone in the central part of the Motagua Valley has not been subjected to thorough recent study. In 1943 the Carnegie Institution spent two months excavating mounds at Guaytan, probably the main site in the zone, and an additional ten days in a "hasty exploration of the area" (Smith and Kidder 1943:109). From this early work comes a sketch map of the Guaytan site, descriptions of the excavations and artifacts recovered during the Guaytan field work, and extremely generalized observations of ruins in the neighboring areas. Also included is a map plotting concentrations of ruins in five-mound units.

Even though Smith's survey was very limited, he noted over 1600 mounds in the approximately 60 km stretch along the Motagua River that was covered, with over 1000 of these concentrated in a 10 km stretch with Guaytan, El Teron, and Magdalena at the center (ibid: 113; Fig 1). Thus, it would seem that the San Agustin archaeological zone comprised a major population center for one part of the Motagua Valley. Two occupational periods with moderate to abundant ceramic evidence were identified -- Lato (corresponding to Early Classic) and Magdalena (Late Classic). Minor amounts of other ceramic material suggest earlier (possible Middle and Late Preclassic) and later (Terminal Classic and Early Postclassic) occupations.

More recently (1979-1981) a research project was initiated at Guaytan which included survey and surface collections as well as test excavations. The 1979 season resulted in the recovery of ceramics that confirmed the occupation of the area from around 400 B.C. onward. Jade workshops were also located and explored (Walters 1979) It seems probable that the San Agustin zone was a center of a jade working industry, supplying jade objects to various parts of Mesoamerica.

Quirigua. The recently completed archaeological research at Quirigua (1974 - 1979) comprised excavation in the site core (Jones and Sharer 1980) and both survey and excavations in the surrounding 95 sq. km. site periphery (Ashmore 1980a). These investigations indicate that peak occupation in both areas of the site occurred during the Late and Terminal Classic period.

Traces of a smaller Early to Middle Classic occupation were found in several areas of the site periphery (Ashmore 1980b). The available evidence indicates that Quirigua was founded in the 5th centery A.D., probably as a colony from the central Peten (Jones and Sharer 1980). However, sparse and deeply buried remains datable to the Protoclassic and Late Preclassic eras, beneath the present water table and therefore essentially inaccessible (Ashmore 1980b), argue for an earlier occupation of the area.

Lower Motagua Sites. Reconnaissance and survey was conducted in the lower Motagua valley as part of the Quirigua Project in 1973-74 and again in 1977-79 (Schortman 1980). In the most intensively studied sample area (180 sq. km. along the southern margins of the valley), Schortman's research located and mapped 20 sites, all dating to the Late and Terminal Classic. Nine of these are monumental in size, three comparable to (or larger than) the contemporary site of Quirigua (Las Quebradas, Playitas, and Quebrada Grande). Although none duplicate all the Classic Maya hallmarks found at Quirigua (such as sculptured monuments and hieroglyphic texts), these sites do share a considerable range of material culture (including ceramics) with Quirigua. Excavations indicate a range of interactions among all the Late Classic lower Motagua sites, and suggest that these centers rose and fell in synchronization with Quirigua.

Western and West-Central El Salvador

Chalchuapa. The most comprehensive archaeological investigations at Chalchuapa were conducted from 1967 to 1970 (Sharer 1978a). The earliest remains at the site are datable to the end of the Early Preclassic era. Occcupation, which appears continuous, expanded for the next millenium, peaking in both size and complexity during the Late and Terminal Preclassic. Cessation of construction and drastic decline in occupation accompanied the Ilopango eruption in ca. A.D. 250, detectable at Chalchuapa by a distinctive level of volcanic ash. Occupation at Chalchuapa gradually recovered thereafter and peaked again in the Late Classic - Early Postclassic eras. In the Late Postclassic - Conquest period, according to ethnohistoric sources, Chalchuapa was occupied by Pokoman Maya (Miles 1957).

Zapotitan Valley. This area has been systematically investigated through a stratified random sample survey combined with excavation at several sites (Sheets, 1983). The survey revealed 54 sites ranging from isolated residences through villages to secondary and primary regional centers. From surface evidence the majority of the sites were occupied during the Late Classic period. A lack of Early Classic settlement seemed to indicate abandonment due to the infertile

layer of Ilopango ash. Preclassic settlements in the region seem to be few in number but that may be circumstantial since they would be hidden beneath thick volcanic deposits. Postclassic occupation was light. Settlement seems to have clustered on the high plains west and north of the basin and along permanent water sources in the basin itself (Black 1978).

CERAMIC FOCUS

Standard type descriptions of the major ceramics dealt with in the research, as well as others mentioned in the text, are given in Appendix B. The main identifying characteristics of the principal types will be presented in this section along with a summary of their history in archaeological research.

Copador Polychrome

Characteristics

Copador is a cream colored, fine paste polychrome type. It features painted motifs of stylized glyphs, human, and animal figures along with some geometric designs. Bowls, both open and recurved, are the most common forms and almost always have interior and exterior painted decoration. The painting style is cursive rather than having detailed fine-line execution. The designs are rendered in specular hematite (deep purple-red in color), black and orange paint; a light orange slip underlies the painted designs. (See Figures 2 through 4.)

Archaeological History

The ceramic type that came to be called Copador is cited from early investigations at Copan and in western El Salvador. For example, Boggs (1944:66) published a description giving characteristics for pieces classified as "red, black, and orange on orange Maya polychrome" found at Tazumal in western El Salvador. The easily recognizable ceramic type was characterized by Boggs in 1945 as:

> "....a distinctive style of painted pottery on which human figures and stylized Maya glyphs or glyph elements are very commonly depicted, as well as to the use of specular hematite paint in the decoration. The usual color combination is red and black on orange slip, but at times vessels decorated in the style are unslipped, at others five or more colors are employed." (Boggs 1945a:246)

The term Copador was first used by Boggs in the 1945 report and was said to have been suggested by Kidder to

Figure 2: Copador Open Bowls

Figure 3: Copador Recurved Bowl with Diagonal Grooving

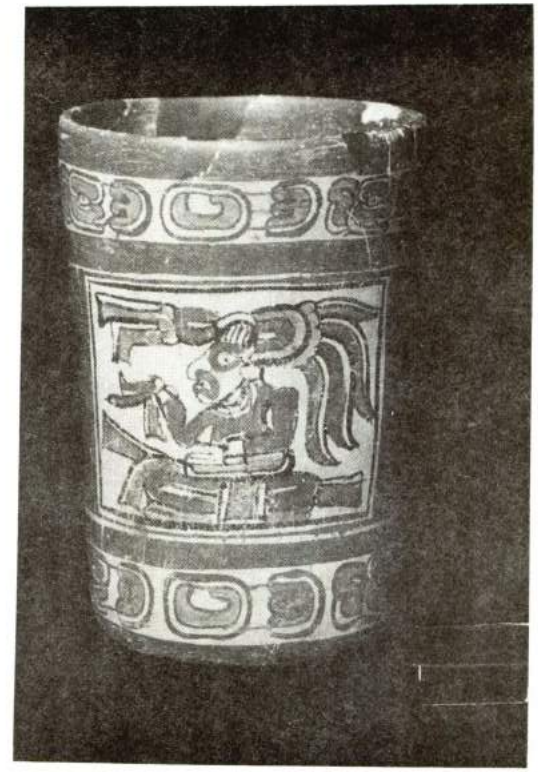

Figure 4: Copador Vases, Seated Figures

imply the principal area of distribution -- Copan and the area around it plus western and central El Salvador.

Its presence in caches below dated stelae at Copan (reviewed and illustrated by Stromsvik in 1941) made it a useful time marker when the style was found at other sites:

-- Boggs 1943 relates Campana San Andres to Copan through Copador ceramics.

-- Boggs 1945 relates Tazumal to Copan pottery and phases.

-- Boggs 1945 relates Club Internacional to Copan.

-- Stromsvik 1950 relates Asuncion Mita to "Copador phase" and thence to the "Maya Classic."

Activity of the Carnegie Institution and the interaction of its archaeologists working in the southeastern periphery helped to informally communicate information and to foster identification of the type. The 1946 Carnegie Yearbook reports:

> "Dr. Longyear has also been engaged in study of the design motifs of Copan polychrome pottery. His analysis, although still in an early stage, shows that the local painted wares were rigidly stylized, both in decorative motifs and in the shapes of the vessels on which given motifs could be placed. It is now possible to isolate these Copan styles from those of imported wares, and also to identify them whenever they occur in the ceramic context of other sites. The importance of this study was fully realized when the pottery from Tazumal, El Salvador, was examined. Many of the polychrome wares of the latter site resemble Copan vessels so strongly that there can be no doubt they both stemmed from the same artistic tradition." (Longyear 1946:204)

Thus, the second major role for Copador was enumerated -- to serve as an indicator of contact among sites where the ceramic was encountered. Longyear, writing in The Maya and Their Neighbors (1940:268-271), cites several Copan ceramics (Copador and Gualpopa, mentioned not by name but by decorative modes) as showing contact with El Salvador. Interestingly, at this time he denigrated the artistic quality of Copan polychromes and said that the sudden appearance of the distinctive style argued against its origin at Copan.

In a slightly later paper, Longyear (1951) classifies Copador as Copan's "local ceremonial pottery" whose highly stylized and symbolic decoration was "dictated by a special school of artists drawn from the priestly class" (ibid: 91). In this historical reconstruction he also states that Copador was produced not only for local use but for export to other centers in the southeastern frontier region.

The fullest discussion of Copador polychrome is found in Copan Ceramics (Longyear 1952:30; 60-64; 99-100), including the topics of its production and distribution. Longyear concludes that Copador was manufactured at Copan and exchanged into the areas where it has been found. His overview of El Salvador archaeology in the Handbook of Middle American Indians (Longyear 1966) restates the Copan export theory of Copador ceramics when he writes: "The Maya culture of Copan also extends to the south, where western El Salvador, cut off from Guatemala by the Mexican invasion there, now imports Copador Polychrome direct from Copan, and Ulua Polychrome from central Honduras" (ibid:155).

Glass (1966), in his Handbook survey of Western Honduras, implicitly accepts the trade ware positioning of Copador, when he states "the most distinctive Late Classic (Copan 'Full Classic') pottery type at Copan, Copador Polychrome, has a distribution that encompasses western and central Salvador as well as Copan but it is almost absent from other regions of Honduras" (ibid: 161).

More recently, Sharer (1978a Vol 3:55) questioned the conclusion that all Copador was made at Copan since he had identified several decorative varieties at Chalchuapa that had not been described at Copan. His tentative conclusion was that "Copador Polychrome was a diverse ceramic tradition, widespread by trade over much of the southern and eastern Maya area, and was probably manufactured at several separate centers" (ibid). Sharer then agrees with Longyear that studies involving technological analysis will be needed to resolve the question.

In summary, Copador has a long-standing reputation as a Copan trade good but one that is based on rather circumstantial evidence.

Other Late Classic painted ceramics have not received as widespread attention as Copador but are known from the literature to have similar distributions. These types will be used in the research to provide a comparative framework for the evaluation of the Copador data.

Gualpopa Polychrome

Characteristics

Gualpopa, like Copador, is a cream colored, fine paste polychrome type. Its dominant shape is an open bowl which usually has painted decoration only on the exterior. Design motifs are restricted to animals and geometric designs, including simple glyphic representations. An orange-cream slip is used over which the designs are painted in black and red (not specular hematite but more of an orange-red). Often the two paint colors are used for different motifs rather than being combined as outline and fill, which is the pattern for Copador decoration. One variety of this type uses a distinctive layout of the exterior wherein the designs "spiral" from the rim down the wall and onto the convex bottom of the bowl. (See Figure 17, Chapter 4.) Gualpopa vessels are illustrated in Figures 5 and 6.

Archaeological History

This group of red and black on orange slip ceramics was described by Boggs (1944:65-66, Pl XIVB,2) at Tazumal under the heading "Red and Black on Orange I." Another piece is illustrated (ibid:Plate XI,5) as coming from the department of La Libertad in the western part of El Salvador. Although not illustrated, "Tazumal Glyphic" and "Tazumal Geometric Polychrome Wares," mentioned by Boggs (1950:272) as having stylistic features of designs comparable to "Copador Phase decorative elements," probably are Gualpopa.

Longyear (1952:58-60) found a sizable amount of this type at Copan (called Polychrome Simple Bowls) which he placed in the full Classic period. He discusses the glyph-like motifs and parallel line patterns used on the bowls, stating the belief that these designs had some meaning other than decoration since they occur so consistently not only at Copan but also in El Salvador.

Sharer (1978a Vol 3:51-51) encountered the type in both Early and Late Classic contexts. He divided it into four varieties based on painted motifs and characterized it as a "diverse and long-enduring, presumably local ceramic tradition" (ibid:52). However, its cream paste, use of glyphic motifs, and similarity in overall compositional layout to Copador raise questions about its relationship to the more dominant Late Classic southeastern polychrome. Its strong presence in both Copan and El Salvador suggests the possibility that Gualpopa was a product of the same type of production and distribution system as was Copador.

Figure 5: Gualpopa Spiral Open Bowl

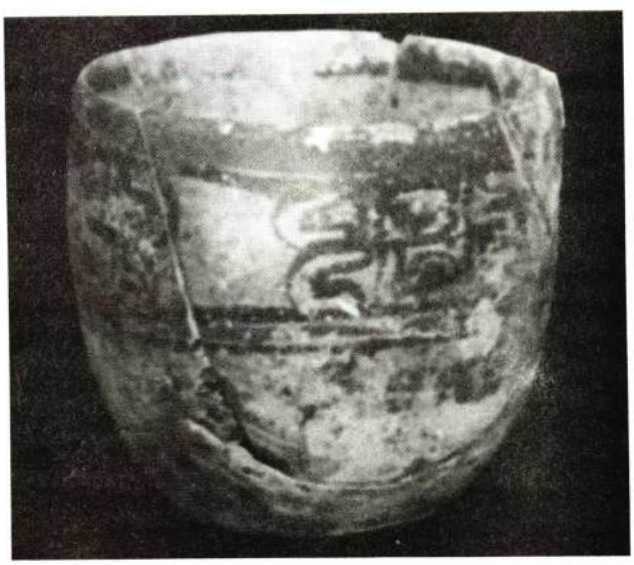

Figure 6: Gualpopa Vase

Arambala Polychrome

Characteristics

Arambala is a red paste type almost exclusively confined to a recurved bowl shape. Seated human figures, bird motifs, and geometric designs are very reminiscent of Copador decoration. Painted motifs -- executed in black, dull (not specular hematite) red, and orange paint -- occur on both exterior and interior surfaces. Painting is often quite sloppy, giving the appearance of having been done hastily or by poorly skilled craftsmen. (See Figure 7.)

Archaeological History

This type was first formally described and named by Sharer (1978a Vol 3: 56-58) at Chalchuapa. Previous investigators had identified the type as a Copador-like ceramic and had informally labelled it as "Imitation Copador" or "False Copador" (Longyear 1952:64). Motifs and vessels forms are allied with some of the Copador varieties but the red paste, lack of specular hematite paint, and the extremely careless rendition of the decoration set it apart. An early description is given as "red and black on orange II" by Boggs (1944:66) for Tazumal specimens and examples from various parts of El Salvador are illustrated in the literature (Longyear 1952:Fig 116; 1944:Plates X 23, 25; XIII 11). Sharer (1978a Vol 3:57) records that Arambala's distribution area is similar to but not as extensive as that of Copador. (Arambala is virtually absent from the Copan Valley.) He outlines its area of occurrence as ranging from the eastern Guatemalan highlands through western and central El Salvador.

Its prominent occurrence at Chalchuapa where Copador is also present in large quantities raises the question of the nature of the relationship between the types. Longyear (1952:64) interpreted "imitation Copador's" common occurrence at Tazumal (Chalchuapa) as an indication of "homemade imitations of the genuine article." Sharer suggests that the differences between the types (and Gualpopa, as well) probably reflect different manufacturing centers but also may indicate temporal or functional variations. The similarities as well as the differences should be assessed when fitting the types into the Late Classic social and economic milieu.

Chilanga Red-painted Usulutan

Characteristics

One additional painted ceramic type is included in the research, Chilanga. This type, which is not a polychrome, appears before the Late Classic period.

Figure 7: Arambala Recurved Bowl

Figure 8: Chilanga Open Bowl

However, because of its soft cream paste which is reminiscent of both the Copador and Gualpopa types, it represents the same ware tradition.

Its dominant shape is an open bowl, like that of Gualpopa. Very simple geometric designs and monkey motifs are executed in red paint (not specular hematite) over an orange slip. Usulutan decoration (a negative or resist technique used to produce a fine line pattern through the slip) is also used, most often on the interior which is not otherwise decorated and sometime on the exterior along with the painted designs. (See Figure 8.)

Archaeological History

Red on orange ware is reported at Copan both in the second part of the Early Classic and in the Full Classic (Longyear 1952:28;30). Usulutan (negative or resist) decoration is said to be more common in the Early Classic than in the later period. Designs on the later ceramics -- silhouettes of animals and humans -- indicated to Longyear a connection between this type and Simple Polychrome Bowls (ibid:30).

Chilanga was described by Sharer (1978a Vol 3:47) at Chalchuapa in the Early Classic ceramic complex. Two varieties were identified on the basis of simple decoration (Chilanga Variety) or more complex motifs (Osicala Variety). From Sharer's field work the type does not seem to persist beyond the Early Classic. However, at the Tazumal section of Chalchuapa Boggs (1944:65) reports a "Later Phase" red on orange dichrome that equates in paste and in one shape with Chilanga. The type also has been recorded in a Late Classic context at La Sierra in the Naco valley of Honduras (Henderson et al. 1979).

Chilanga appears, then, to have a considerable temporal and geographical span. Its sharing of paste tradition with both of the cream polychrome types and of design motifs with Gualpopa raises questions about its role in the production and distribution systems. Consequently, it was used as a comparative type in the various analyses.

SUMMARY OF RESEARCH GOALS AND METHODS

The primary goal of this research was to test the hypothesis that Copador serving vessels were the result of specialized production in a restricted geographic area from where they were distributed to the various known proveniences.

Production

Hypothesis I The Copador vessels found in various proveniences are a result of material exchange

rather than stylistic exchange or interaction. That is, they were produced in a restricted geographic area using clays from a similarly restricted area.

Test. Clays from the same procurement zone often are quite similar in their trace elemental composition. If Copador is the product of material exchange, vessels should show very similar chemical paste compositional characteristics, regardless of their provenience. Neutron activation analysis of Copador specimens from various proveniences will be used to determine the homogeneity or hetereogeneity of chemical trace elements.

Hypothesis IA. Production of Copador took place in the Copan Valley.

Test. If Copador was made in the Copan Valley, there should be a basic correspondence between the trace elemental composition of Copador clays and those used for ceramics judged to be indigenous to the Valley. A comparison of the trace element composition of local Copan Valley pastes and Copador pastes will be made.

Hypothesis II. The conversion of the clay to finished vessels was done by craft specialists working within a production system geared to standardization and simplification.

Test. Variability in various aspects of the vessels' shapes and decoration will be analyzed to assess the level of standardization and simplification.

Hypothesis III. The size of the production system -- number of production units and the amount of ceramics made -- relates to a complex exchange system, either redistribution or marketing.

Test. The relative number of production units will be inferred from standardization data. The amount of ceramics produced will be assessed from the size of the marketing area, that is, the number of sites within the area where the ceramics were discovered.

Comparative materials -- Gualpopa and Arambala Polychromes, Chilanga Red-Painted Usulutan -- are included in the tests of the production related hypotheses to provide a basis for comparison and evaluation of the Copador data. These other ceramic types also provide supplemental information about the ceramic industry in the southeastern periphery during the Late Classic period.

Distribution and Consumption

Data limitations prevent the use of quantitative methods to investigate details of the ceramics' spatial

distribution. Without frequency information for vessels by provenience relatively little can be done to directly determine the characteristics of the exchange system. Consequently, only two aspects of distribution will be dealt with on a descriptive basis -- directionality and size.

Directionality is an important aspect of spatial distribution because it implies a preferential supply of the exchanged ceramics (Renfrew 1977:85). This, in turn, provides clues about the nature of the exchange network. The size of the exchange territory can indicate the amount of energy expended to distribute the material. Also, the scale of the distribution and the form of production are interrelated (Earle 1982a:8).

Consumption will be described in terms of the specific loci of occurrence: high or low status domestic context; burials, etc. These analyses are undertaken in the belief that exchanged commodities carry symbolic meaning which has significance both in terms of the exchange and the broader society (Earle 1982a:9). Thus, the social context within which the exchanged items are used can reflect socioeconomic status, regional political and economic alliance, and variations in the nature of ceramic production (Hantman and Plog 1982:242-245).

Excluded Topics

At this point mention should be made of several topics that will not be covered in the following chapters. The origin or derivation of the Copador design elements will not be investigated nor will Copador's possible influence on other ceramic styles. The symbolism or iconography of the design motifs will not be evaluated.

These are important considerations for understanding the societal positioning of the ceramics. Just as a class of commodity such as Copador ceramics carries symbolic meaning, the design motifs used in decorating Copador vessels would be expected to have significance in the ideological and symbolic spheres. The question of symbolic associations over space, deemed important by Hodder (1982:208) and others, is examined for the category of the ceramics as a group. A more detailed study based on the design motifs themselves was beyond the scope of what could be accomplished in this work.

CHAPTER 2

RESOURCE UTILIZATION: CERAMIC PASTE CHARACTERIZATION

BACKGROUND

Trace element characterization of raw materials is widely used in archaeology as a means of establishing the pattern of resource utilization and the distribution of artifacts from those resources, usually through trade (Harbottle 1982b). This type of analysis grows out of the fact that most naturally occurring materials contain very minor amounts of trace elements that, in terms of their combination and concentration, will vary from source to source. Thus, it is possible through chemical "fingerprinting" to evaluate whether similar materials came from the same or different sources.

The analytic technique of fingerprinting has been used to study a variety of raw materials which enter the archaeological record either in the form of finished artifacts or as waste from the manufacturing process. Harbottle (ibid:31-38) has recently given a bibliographic summary of five categories of materials that have been subjected to various characterization procedures: stones and minerals, ceramics and clays, natural products (amber, seashells, ivory, and bone), metals, and glass.

In these studies, the usual procedure is to obtain a trace element pattern for possible sources of raw materials, develop a similar pattern for artifacts of interest, and statistically compare the artifact characterizations with the source characterizations to determine the "fit."

Although one of the earliest uses of trace elemental analysis was in ceramic provenience studies (Sayre and Dodson 1957; Young and Whitmore 1957) complications in the study of fired ceramics exist which are not as evident in the study of many raw materials. Clay undergoes a variety of alterations as it is changed from a raw material to a finished ceramic product. Some of these chages can decidedly affect the trace elemental characteristics of the clay versus that of ceramics made from that clay. (See Rice 1978 for an excellent discussion of these factors.)

While researchers have had some success in finding a correspondence between a particular clay source

and pottery made from that source (Hammond et al 1976; Branstetter-Hardesty 1978; Rice 1976), alternative methods of analysis have been sought. In general, the approach has been to establish the compositional characteristics of a site's ceramics so that "local" versus "imported" types can be identified. Work with suspected trade wares also begins with an assessment of the similarity of their chemical composition: were they made from the same clay resource? Then the question of their production locus is approached through a comparison with trace element "fingerprints" of the pottery presumed to be locally produced from various sites.

A variety of specific problem orientations can be found in the growing body of literature concerning ceramic paste characterization analysis. Methodological and statistical data reduction techniques have become increasingly more refined within the last decade as archaeological ceramics from both hemispheres have been subjected to this type of analysis. Most studies, moreover, have aimed at determining production provenience by analyzing pottery without trying to match existing clays to the archaeological ceramics.

Brookhaven National Laboratory is one of the major institutions engaged in chemical characterization of archaeological ceramics through neutron activation analysis. A continuing project on Maya ceramics has been in process for some time and a substantial data base related to various sites has been established. An affiliation with the laboratory was arranged so that I could work there for several periods in 1980 and 1981, participating in the analysis of ceramics and in the interpretation of the results.

The first objective of this part of the research was to assess whether Copador was the product of localized production in one area, thus utilizing clays from a similarly restricted geographic area. Clays from the same procurement zone usually are quite similar in their trace elemental composition (cf. Brooks et al. 1975; Bishop 1980). Thus, if Copador is the product of this type of resource procurement and production, specimens should show very similar chemical paste compositional characteristics regardless of their provenience.

Second, if Copador does appear to have been made in a restricted production area, was the Copan Valley that location? Localized production of Copador in the Copan area would result in corresponding trace elemental composition of clays used for Copador and for other similar ceramic wares judged to be indigenous to the Copan Valley. Some variability might be engendered due to a temper-clay interaction effect if the "local" wares were heavily tempered since the "fine" Copador ware was not. Nevertheless, a basic correspondence

would be expected if Copador had been manufactured in the Copan Valley.

Finally, questions about other ceramic components from the southeastern Maya area vis-a-vis Copador could be addressed. Several cream paste ceramics, Chilanga Red-Painted Usulutan and Gualpopa Polychrome, occur in approximately the same distribution area as Copador. One of these, Chilanga, appears to be temporally earlier than Copador. Do the various components of the southeast Maya cream paste tradition all represent products of a similar type of an economic subsystem or can differences in the pattern of resource utilization and production be detected among the types? Do production related data about Chilanga give any insight into the development and spread of the more recent Copador (and, secondarily, of Gualpopa)?

A polychrome type, Arambala, stylistically related to Copador and seemingly coeval with it, is also of interest because of its occurrence within the general Copador distribution area. Arambala, however, is not a part of the cream paste tradition, having been made of red-firing clays. Thus, its compositional analysis was a separate issue from that of the fine-paste cream ware types. Because of its stylistic similarity to certain Copador varieties, questions arise about its role during the Late Classic period in the southeast area. Was it perhaps a substitute for Copador? Was it manufactured in a production system similar to that of Copador or different? These questions could not receive as full an examination as those related to Copador and the other cream ware types. Nevertheless, compositional analysis was carried out on a sample of Arambala sherds along with domestic wares from several locations in western and west-central El Salvador, the area thought to be a likely Arambala manufacturing locus.

METHODOLOGY

The Data Base

Pottery for the study came from a number of field projects recently conducted in the southeast Maya area. The different geographic zones described in Chapter 1 were the foci of these investigations. Additional materials collected from other sources added to the data base and widened the geographic scope of the

compositional analysis.[4]
Table 3 shows the provenience for the various types of cream ware ceramics analyzed for chemical composition. Table 4 gives the same data for the sample of Arambala and other red paste ceramics.

Activation and Counting Procedures

Since archaeological ceramics have been analyzed at Brookhaven for over 25 years, standardized procedures have been established for all the steps in the activation and determination of the basic elemental concentrations. These are summarized in Appendix C from the most recently published description (Bishop, Harbottle, and Sayre 1982).

Selection of Elements For Analysis

Concentrations of many elements can be measured through neutron activation. However, a number of them are not used in the data analysis because of limitations due to their behavior during the activation process, problems related to the element's role in ceramic materials, or complications arising from the geologic nature of the general region from which the ceramics originate. In general, the goal is to use elements that are most likely to provide interpretable patterned results rather than generate spurious variation; in other words, to distinguish the "signal" from the "noise." For example, preferred isotopes are those that have:

1. A gamma peak that is free of interferring isotopes

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[4]The projects providing data for the chemical characterization analysis include in Honduras, the Copan Valley Project, Harvard University (Willey, Leventhal and Fash, 1978; Willey and Leventhal, 1977) and the Rio Amarillo (La Canteada) Project, UCLA (Beaudry, 1977); in El Salvador, the Zapotitan Protoclassic Project, University of Colorado (Sheets, 1978; Sheets, 1983) and the Chalchuapa Project, University of Pennsylvania (Sharer, 1978a); in Guatemala, the Quirigua Project, University of Pennsylvania (Sharer, 1978b); and the Maya Jade and Ceramics Project of the Museum of Fine Arts, Boston, in collaboration with Brookhaven National Laboratory. Material from the Tiquisate region of Guatemala and from the sites of Asuncion Mita and Guaytan were made available through the courtesy of the Museo Nacional de Guatemala. Pottery from San Agustin Acasguastlan was submitted by Gary R. Walters. Research at Brookhaven National Laboratory is conducted under contract with the U.S. Department of Engergy and supported by its Office of Basic Energy Sciences.

TABLE 3

Provenience By Type, Cream Paste Ceramics
Used in Chemical Composition Analysis

Provenience	Ceramic Type			
	Copador	Gualpopa	Chilanga	Total
Copan	53	13	11	77
Rio Amarillo	8	10	12	30
Western Honduras	61	23	23	107
Chalchuapa	22	13	6	41
Zapotitan Valley	14	19	-	33
Western Salvador	36	42	6	74
Quirigua	4	6	4	14
Lower Motagua	4	-	-	4
San Agustin A.	4	8	2	14
Motagua Focus	12	14	6	32
Naco Valley, Honduras	-	-	3	3
Asuncion Mita, Guatemala	2	1	1	4
Pusilha, Belize	19	-	-	19
Tiquisate, Guatemala	-	-	1	1
Total	131	70	39	240

TABLE 4

Provenience By Type, Red Paste Ceramics

Type (Complex)	Chalchuapa	Zapotitan Valley	Total
Arambala (Payu)	13	11	24
Thin wall, red paste			
Suquiapa (Xocco)	3		3
Pajonal (Caynac and Vec)	1		1
Tepeto (Payu)	6		6
El Pito Group (El Pito Cream Slipped and Belmont red on cream) (Payu)[a]		3	3
Thick wall, red paste			
Aguacate (Caynac and Vec)	6		6
Guazapa, Majagual Variety (Payu)	11	18	29
Jujitla Group (Jujuitla and Cusmapa types) (Caynac and Vec)	9		9
Huascaha - (Caynac and Payu)[a]		2	2
	49	34	83

[a]This type was first described in the Zapotitan Valley. Complex names are not assigned to the excavated collections of that project (see Beaudry, 1983). Thus the Chalchuapa temporally equivalent complex is noted in parentheses for references purposes.

2. Good counting statistics or standards available.

Some elements will be eliminated because of considerations related to the nature of clays and ceramic pastes. For instance, an element is a problem if it substitutes for another element in many mineralogic sources since variability would be inferred within otherwise homogeneous material.

Similarly, some elements can be carried either in the clay only or in both the clay and the aplastic inclusions (temper). Interpretation of the meaning of a certain level of that element's concentration can be imprecise. Finally, information about the geologic nature of the general area may justify the elimination of other elements.

Concentrations for 16 elements were retrieved from the activation and counting procedures: Rb, Cs, Ba, Sc, La, Ce, Eu, Lu, Hf, Th, Cr, Fe, Co, Ca, Sm, and Yb. Reliable peak values could have been determined for more elements but with a substantially greater investment of time and effort. Drawing upon Brookhaven's extensive experience in the analysis of Mesoamerican and other archaeological ceramics, this project limited its focus to a moderate number of elements that had proven useful in earlier research.

The elements selected after the basic data set had been prepared were: Rb, Cs, Ba, Sc, La, Ce, Eu, Lu, Hf, Th, Cr, Fe, Co, Sm, and Yb. Several of these were subsequently removed from certain stages of the analysis. The elements and the reasons for their elimination will be specified as the analysis is described.

Technique of Data Analysis[5]

Various multivariate statistical procedures were used at different stages of the analysis. The reasons for selecting the techniques will be described, as needed, in the following sections. However, the overall approach to the data is outlined here.

The outline nature of the presentation should be emphasized. During the course of the project numerous experimental analyses were run to check impressions about possible relationships and to be certain that mathematical considerations were fully understood.

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[5]This section describes the stages of the analysis as carried out for the cream paste ceramics. The red paste Arambala ceramics will be discussed in a later section of this chapter.

Many of these data excursions were unproductive and so are not covered in this text. The outline follows:

1. Review data set by checking interrelationships among elements and assess the amount of variance present in the elements - principal components analysis (BMDP4M).

2. Attempt preliminary group formation among cases - cluster analysis of cases using an average linkage of Euclidean distances:

   a. NADIST (Brookhaven developed program) produces transformed standardized elemental data and orders them into a similarity matrix.

   b. AGCLUS (Harvard University) performs an aggregative hierarchical clustering on the NADIST similarity matrix.

3. Evaluate the reference group cluster - a specialized form of discriminant analysis, ADCORR (Brookhaven developed) was used.

4. Transform data to obtain standardized characteristic vectors (eigenvectors).

5. Form and evaluate new reference group - using ADCORR again.

6. Compare reference group with several smaller clusters - discriminant analysis (SPSS) was performed to check the accuracy of the allocation of cases to the reference groups and to determine the statistical separability of the three groups.

FINDINGS, CREAM PASTE CERAMICS

Preparing and Reviewing the Data Set

A principal components analysis, including varimax rotation of retained factors, was done using BMDP4M. Four factors emerged with the loadings shown in Table 5. Factor 1 loads heavily on the rare earth elements which are carried predominantly in the fine fractions of the clay. Factor 2 loadings relate to alkalai elements while Factor 4 loads primarily on Hf. Factor 3 loads with transistion and related metals.

The overall pattern of the factors and their loadings fit the general expectations for data sets of ceramic material from the Mesoamerican region, reflecting the general area-wide patterns of elemental covariations. Various statistics produced as a part of the factor analysis computer run were examined to be

TABLE 5

Sorted, Rotated Factor Loadings
Cream Paste Ceramics

Element	Factor 1	Factor 2	Factor 3	Factor 4
Sm	0.974	0	0	0
Eu	0.941	0	0	0
Yb	0.920	0	0	0
Lu	0.895	0	0	0
Ce	0.891	0	0	0
La	0.884	0	0	0
Rb	0	0.876	0	0
Cs	0	0.855	0	0
Th	0.351	0.646	0	0.475
Fe	0	0	0.782	0.302
Co	0	0	0.771	0
Cr	0	0	0.763	0
Sc	0.324	0	0.507	0.374
Ba	0	0	0	-0.702
Hf	0.343	0.429	0	0.645

NOTE: In this program, loadings less than 0.2500 are replaced by 0.

certain that no unusual circumstances were present which might cause problems in the rest of the analysis:

1. Calculated factor scores and Mahalanobis distances for each case were checked to determine if any cases were very aberrant in terms of their pattern of elemental concentrations not being accounted for by the identified factors. Several very noticeable outliers were removed from the data set.

2. The correlation matrix was examined to determine if the pattern was acceptable for using Euclidean distance in the initial cluster analysis work. Of the 105 correlations, 16 were 0.600 or higher. This level of association was not so strong as to preclude using Euclidean distance (see Rohlf 1967).

3. The table of squared multiple correlations (SMC) showed that barium had a very low SMC (0.115). This initial estimate of communality indicated that barium's overlap with the other variables was quite limited. The correlation matrix also showed barium as having a negative correlation with a number of other elements even though at a low level. Its strong negative loading on Factor 4 further suggested an isolation from the other elements.
   The reason for barium's observed behavior is thought to relate to the geologic characteristics of the southeast Maya region -- an area of volcanically derived soils and clays. (In fact, although the pottery being studied could be characterized as having a temperless texture, volcanic glass particles in the paste are not uncommon.) A correlation between barium concentration and the amount of volcanic glass has been found in other Maya pottery (Bishop and Rands 1982), and so it was decided to eliminate the element during the stage of initial group formation. Likewise, since rubidium can substitute in similar crystal loci as barium (Bishop 1980) and so might be related to varying amounts of volcanic glass, it seemed prudent to remove it also, thereby guarding against "noise".

4. The univariate statistics for the variables showed that Eu had a very large coefficient of variation due to a large standard deviation relative to a very small mean. The element was not removed but was "flagged" to be watched during the analysis. In the early stages of analysis it is frequently difficult to ascertain whether or not observed variation is a function of an analytical error, is actual variability related to the multicomponent nature of the pottery, or is indicative of procurement or production patterns.

At this point the data set was considered appropriate to continue with the analysis.

Preliminary Group Formation

A Euclidean distance matrix expressing the level of similarity of each data point relative to all other data points was produced through the Brookhaven NADIST program. This program transforms the elemental data into log-normalized units since the concentrations are initially recorded either as percents or as parts per million. In the absence of such a transformation, the Euclidean distance calculation would be biased due to the abundance of the major elements (e.g., iron, as a percent; rare earths extending to below parts per million.) The similarity matrix then was used to perform aggregative hierarchical clustering through the AGCLUS program. Similar samples were joined using average linkage cluster analysis with the results summarized in a dendrogram (Sneath and Sokal 1973:124, 228-230).

This set of procedures was done using as variables the elements initially selected but excluding Ba and Rb for reasons explained in the previous section. Then it was repeated, excluding the elements Cs, Hf, and Co. All three of these elements, upon occasion in past analyses, have "distorted" initial clusters: Cs because it has a fairly large counting error, Hf because it often reflects univariate variability in groups within the Maya area (its geochemical behavior is poorly understood), and Co because it varies in terms of being in the clay minerals or present as an accessory, thereby confusing interpretation. Indeed, the patterning was more pronounced when these three elements were not used as variables. The results of this step of the analysis, consequently, are based on the oxide concentrations of the elements Sc, La, Ce, Eu, Lu, Th, Cr, Fe, Sm, and Yb.

An examination of the dendrogram (Figure 9) shows several small clusters of cases. Three closely similar groups were of special interest because about half (33 of 77 cases) were Copador pottery having a Copan provenience. These three groups were then merged to form a trial reference unit, presumably representing a characteristic chemical profile for Copador pottery used at Copan.

Evaluation of Reference Group

The ceramic specimens not included in the trial reference group were assessed to determine if they did belong in the group. The heuristic assumption here is that the group is a statistically random sample drawn from an infinite, multivariate population. Thus the probability of an individual data point (ceramic sample or specimen) belonging to that group can be calculated using the ADCORR program (Sayre 1973).

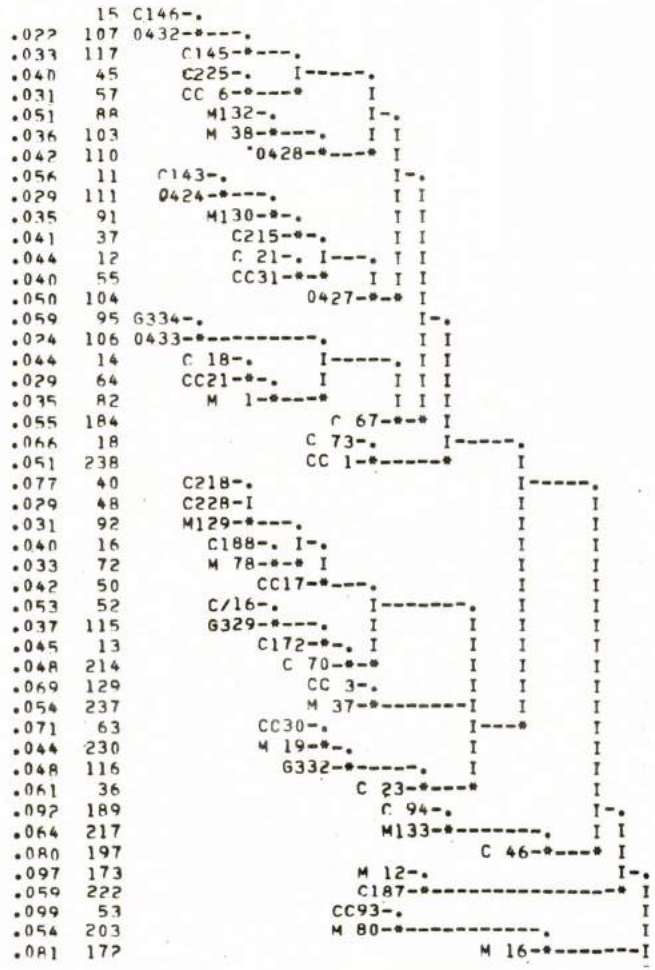


Figure 9: Dendrogram For Cream Paste Ceramics (Variables = ten elements; log-normalized units)

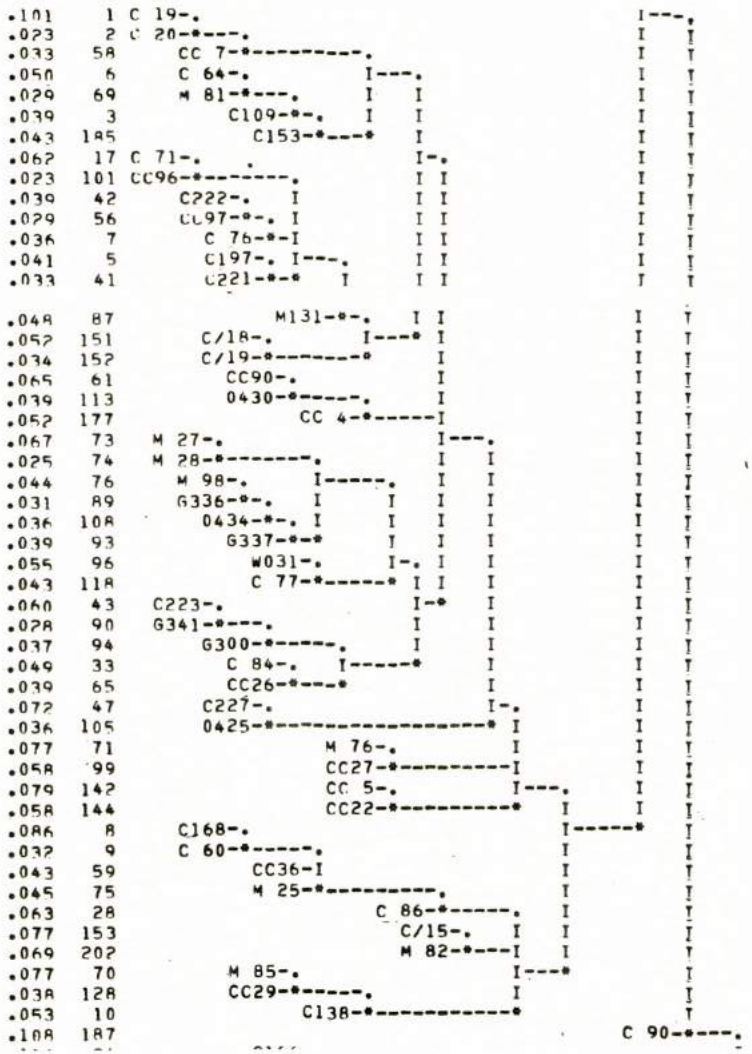


Figure 9 (Continued)

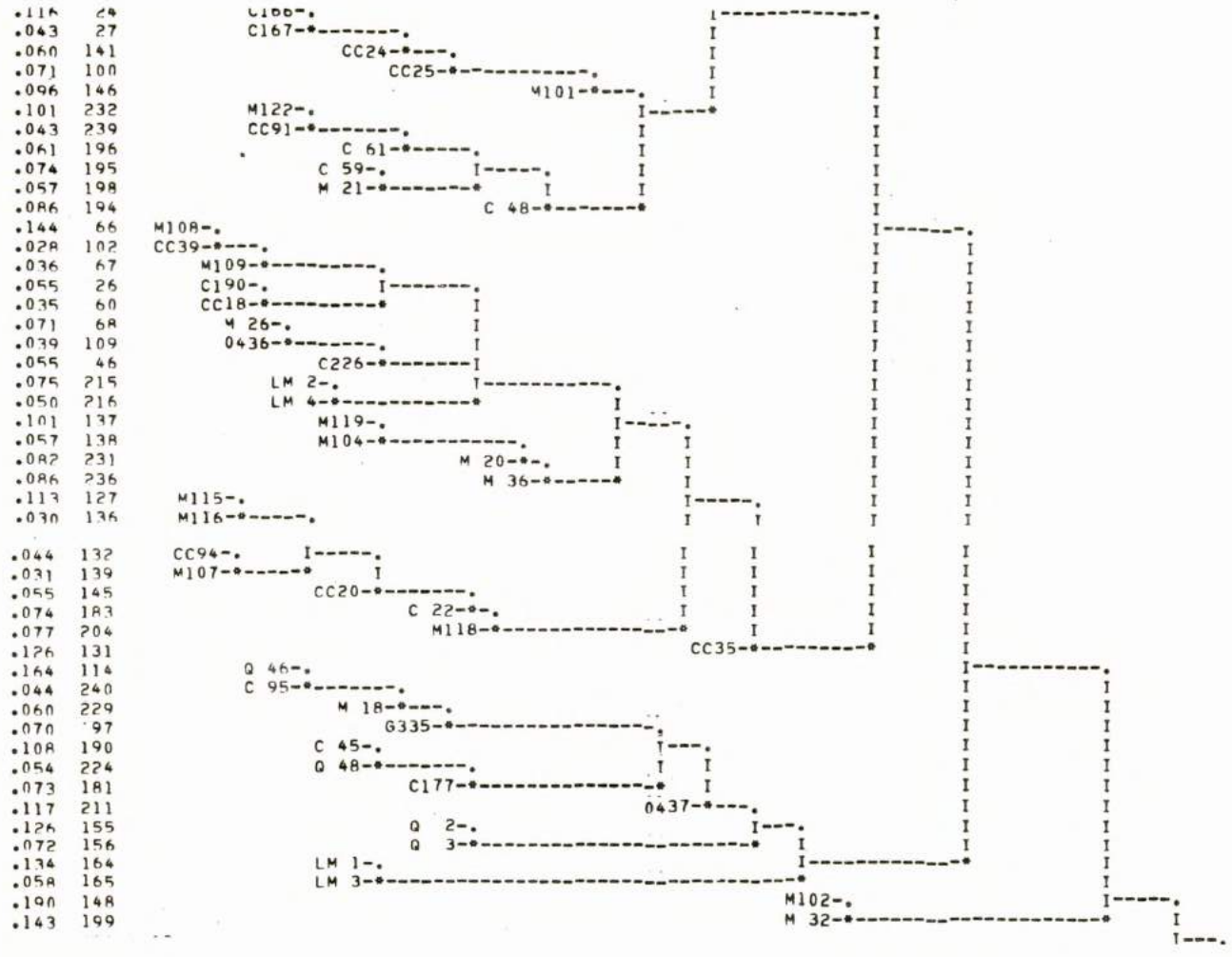


Figure 9 (Continued)

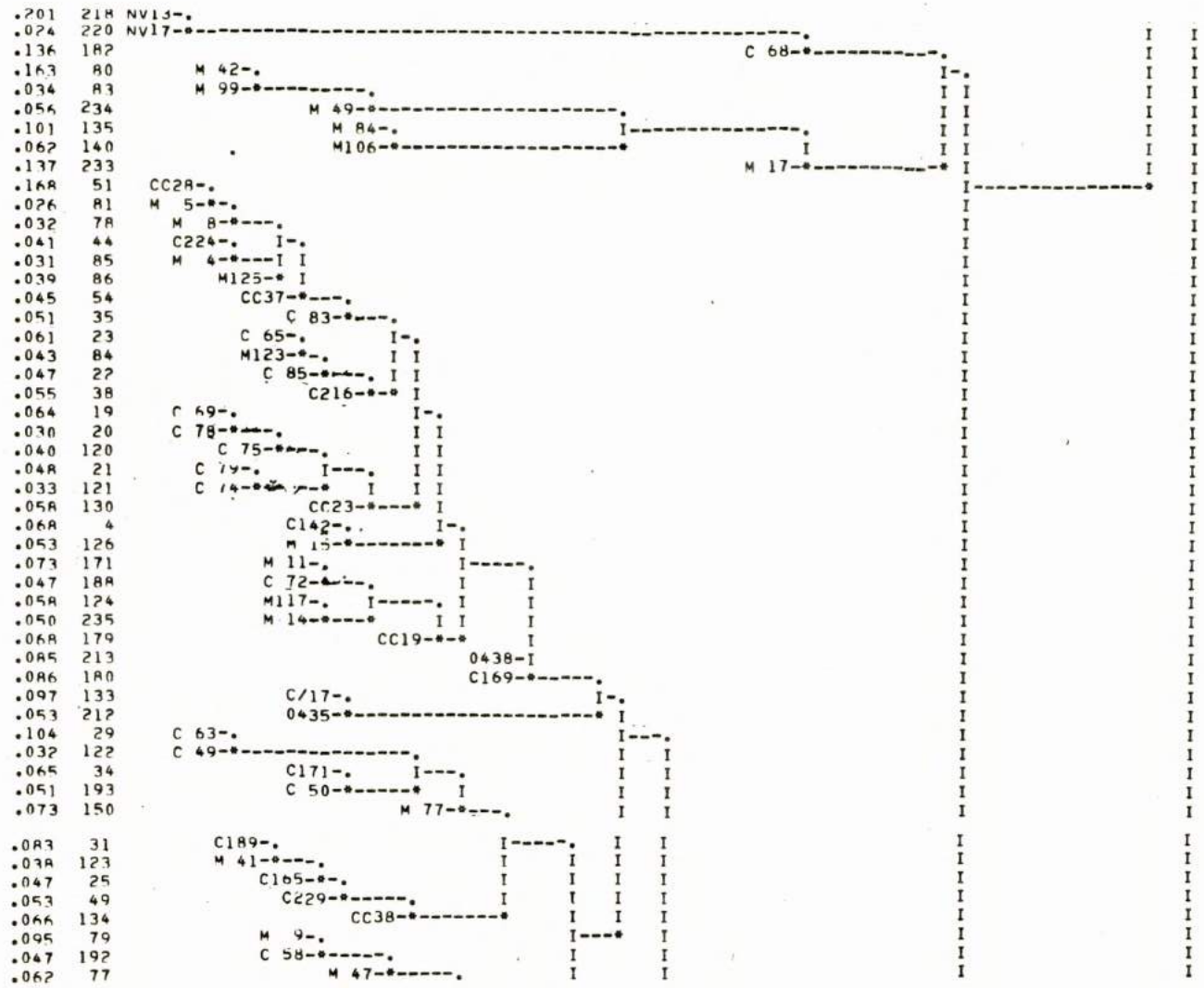


Figure 9 (Continued)

Figure 9 (Continued)

There are two steps in this analysis:

1. For each data point (grouped or ungrouped specimen), determine the Mahalanobis distance which is the squared, standardized Euclidean distance from the group centroid to the data point divided by the group standard deviation in that direction.

2. Calculate the probability of that specimen's belonging to a given group as expressed by Hotelling's T^2, a multivariate extension of Student's t statistic.

Unlike more rigorous statistical tests, the determination of at what level of probability a sample will be considered a group member is up to the investigator, noting the individual sample probability and the extent of covariation with archaeological data such as site, form, style, time, etc. It was decided to accept specimens having at least a 10 percent probability of belonging to the same population from which the trial reference group had come. It should be emphasized that this level of probability is calculated for the case as an "outsider" -- its variable states are not part of the data upon which the group centroid is determined. Thus, the criterion is more rigorous than it might initially appear.

Using this procedure, specimens which had been found in other clusters on the dendrogram were added to the trial reference group -- many with a very high likelihood of group membership.

The question arises as to why these specimens did not initially cluster with the trial reference group. Part of the reason for this apparent initial group fragmentation undoubtedly is due to the nature of the clustering algorithm and the role played by elemental intercorrelation. Rohlf (1967) well documented that the presence of correlated variables tends to distort the relationships among cases, especially when the data are subjected to clustering of the Euclidean distances among cases (Blackith and Reyment 1971:11). With strong intercorrelation the data are "stretched out" along the directions of correlation, forming an ellipsoidal distribution. Clustering techniques, such as average linkage of Euclidean distances, fail to adequately cope with such data. While points in the denser areas may be grouped together, points at the two ends are frequently forced into separate groups.

It will be recalled that the number of high interactions observed from the initial correlation matrix did not seem to preclude the use of Euclidean distance. However, it is difficult to establish with certainty the number or strength of interconnections

that will affect the clustering technique to the point where a "degenerative" solution will result.

Inspection of the trial reference group correlation matrix revealed the pattern shown in Table 6, with very high correlations existing among the rare earth elements La, Ce, Eu, Lu, Sm, and Yb. The pattern of elemental correlations can be quite characteristic for a given clay procurement region and so should be retained in the data set. However, in order to more realistically reflect the multivariate relationships present in the data matrix during the cluster analysis, some normalization of the data was required.

Transformation of Data

A convenient transformation of the data involved their normalization relative to the variance-covariance matrix of the Copan provenience sherds in the trial reference group. From this matrix, standardized characteristic vectors (eigenvectors) were obtained which constituted a new set of uncorrelated axes. Sample coordinate positions were defined by projection onto these axes, maintaining the relative positions of the data points (Sayre 1973; Bishop et al., n.d.b). Variable loadings comprising the vector associated with the greatest amount of variation in the data set were found to be of the same sign, suggesting that this vector might be attributable to "size-related" variability in the data (Rao 1964; Sneath and Sokal 1973:173). Such variation might result from a nondetermined component, such as silica, introduced by varying amounts of volcanic particles. Since a chemical profile of pottery is a weighted expression of all components, the presence of a material lacking the elements being used as variables would lower the absolute concentration but would not alter the sample to sample proportional similarity. The negative correlation of barium with most of the other elements discussed earlier tends to support the assumption that elemental ranges were being affected by nonclay components of the pottery. To the extent that this interpretation is correct, sample similarity based on absolute elemental concentration would tend to distort the "natural" number of groups present in the data set.

New Reference Group Formation and Evaluation

Average-linkage cluster analysis was carried out as before but now employing the sample loadings on the characteristic vectors as the variables. In order to reduce the potential size related variation, the vector associated with the largest eigenvalues was not included. The resulting dendrogram (Figure 10) revealed one large cluster of samples and two smaller clusters (one rather poorly defined), as well as a considerable number of samples which showed little tendency to form

TABLE 6

Correlation Matrix For Expanded
Trial Reference Group

ELEMENT	SC	TH	CR	FE	LA	CE	EU	LU	SM	YB
SC	1.000									
TH	0.461	1.000								
CR	0.349	-.065	1.000							
FE	0.722	0.212	0.417	1.000						
LA	0.380	0.399	0.274	0.233	1.000					
CE	0.325	0.364	0.243	0.166	0.944	1.000				
EU	0.392	0.327	0.358	0.188	0.864	0.898	1.000			
LU	0.487	0.452	0.211	0.248	0.799	0.792	0.875	1.000		
SM	0.357	0.397	0.274	0.169	0.891	0.925	0.973	0.882	1.000	
YB	0.377	0.366	0.198	0.194	0.774	0.803	0.906	0.931	0.908	1.000

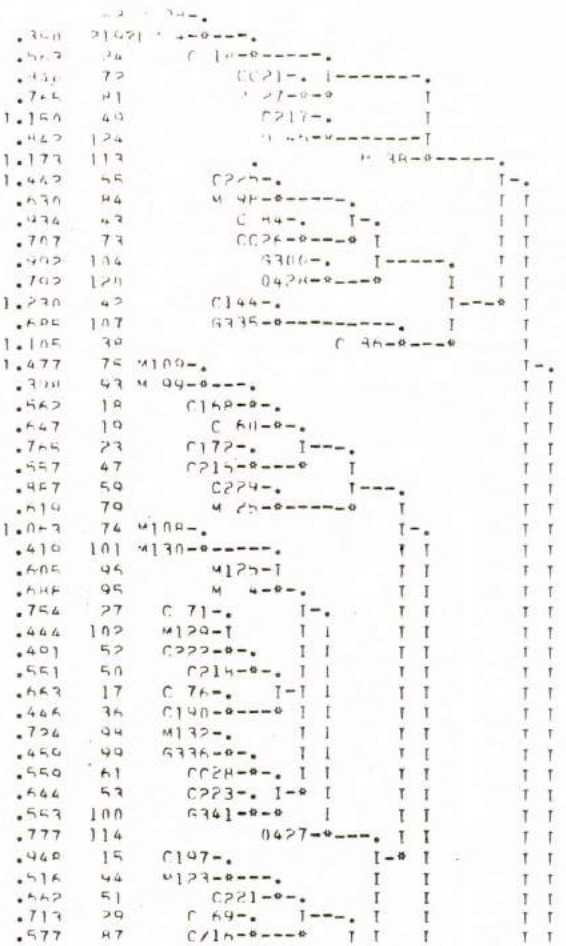


Figure 10: Dendrogram For Cream Paste Ceramics (Variables = nine characteristic vectors)

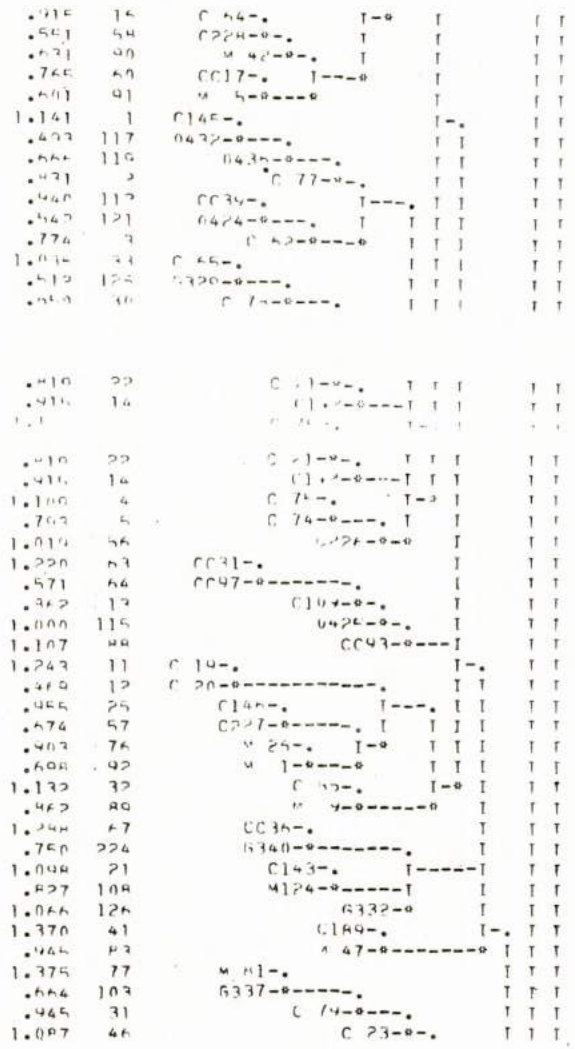


Figure 10 (Continued)

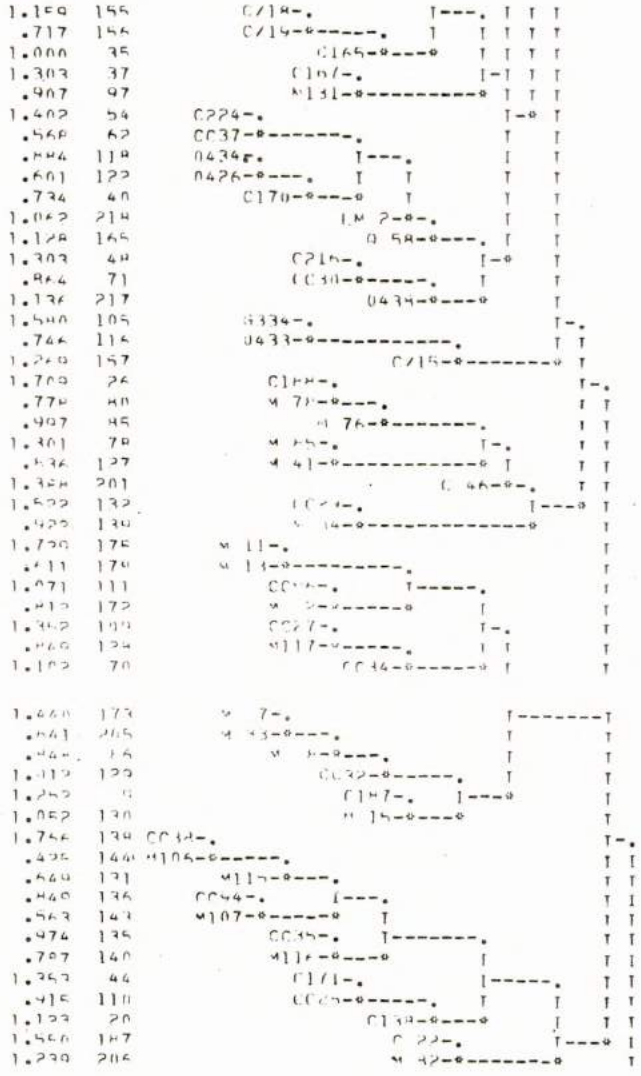


Figure 10 (Continued)

Figure 10 (Continued)

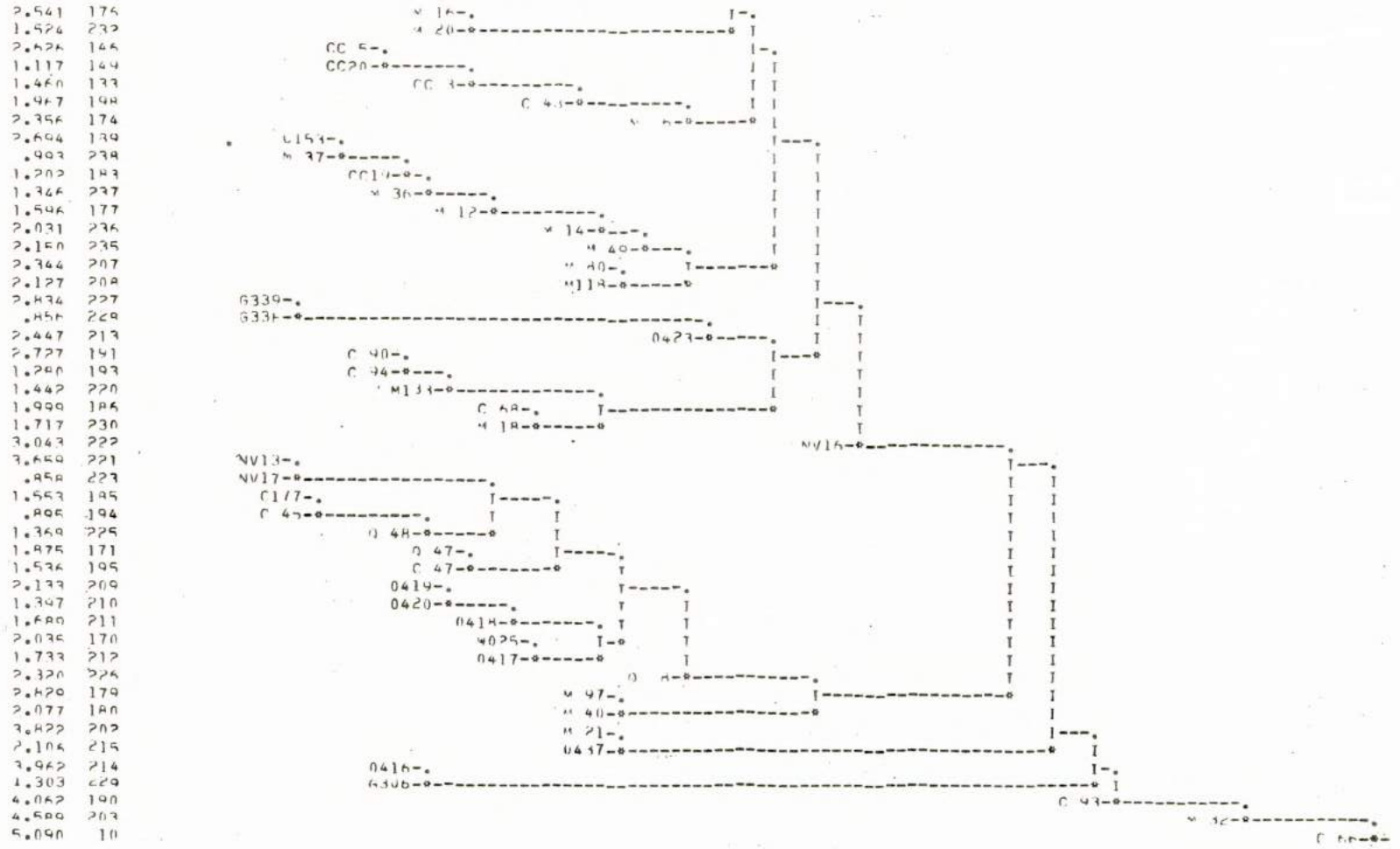


Figure 10 (Continued)

compact or homogeneous groups. The large clustering was of particular interest for it contained the earlier trial reference group samples, as well as additional Copador, Gualpopa, and Chilanga pottery.

Using the newly obtained cluster as the reference unit, Mahalanobis distances and probabilities of group membership were again calculated. Those specimens not in the large cluster but having a membership probability of greater than 10 percent, were added to the group; any group member which fell below the 10 percent probability was removed. Statistical evaluation and specimen addition or subtraction continued until no further samples fell with the chosen probability range. The sample membership within this enlarged and refined reference group is summarized according to typological assignment and site provenience in Table 7. Due to the predominance of pottery of a Copan provenience, this chemically derived compositional unit will be referred to as the Copan-focus reference group.

TABLE 7

Sample Membership In The Preliminary Copan-focus Reference Group

	Ceramic Type			
Provenience	Copador	Gualpopa	Chilanga	Total
Copan	43	9	3	55
Rio Amarillo	5	1	8	14
Western Honduras	48	10	11	69
Chalchuapa	13	9	4	26
Zapotitan Valley	7	6	-	13
Western Salvador	20	15	4	39
Quirigua	0	0	1	1
Lower Motagua	0	0	0	0
San Agustin A.	0	6	2	8
Motagua Focus	0	6	3	9
Naco Valley, Honduras	-	-	-	-
Asuncion Mita, Guatemala	2	1	1	4
Pusilha, Belize	10	-	-	10
Tiquisate, Guatemala	1	-	-	1
Total	81	32	19	132

At this stage of the analysis 55% of the cream ware sherds were included in the Copan-focus reference group. The rest were either left in the two smaller clusters of the dendrogram or did not seem to associate together to any extent. The next step was to determine what relationship the Copan-focus group had to the other clusters.

Comparison of Copan-focus Reference Group With Other Clusters

A check of the provenience of the sherds left in each of the two smaller clusters revealed that both groupings were quite region specific in nature: one contained primarily samples from El Salvador; the other was composed of pottery from sites in the Motagua River Valley.

Each cluster was used as a reference group, and Mahalanobis distances and probabilities of group membership were assessed via the ADCORR procedure. Following the membership probability criterion of 10 percent, specimens were added or removed from the reference group. The result was an El Salvador-focus reference group (N=21) and a Motagua-focus reference group (N=14).

These groups and the Copan-focus reference group were submitted to discriminant analysis (SPSS), employing the full set of elemental variables (that is, the 15 initially selected, including Ba, Rb, Co, Cs, and Hf). Using the classification options within the discriminant analysis program and a pooled variance-covariance matrix (Klecka 1975:436), five samples, all from Chalchuapa in El Salvador, were judged to have been misclassified in the Copan-focus reference group, belonging instead to the El Salvador-focus cluster.

Subsequent rerunning of the discriminant analysis showed all samples to be correctly classified and all groups separable at a statistically significant level (p 0.001). Group membership is summarized in Table 8. The separation of the groups from each other is illustrated with reference to the two discriminant axes in Figure 11. Variable loadings on the derived discriminant functions are given in Table 9.

It will be recalled that the separations achieved are multi-variate in nature. This is of importance because inspection of the group elemental means and standard deviations (Table 10) reveals considerable univariate overlap of concentrations at one standard deviation. (One notable exception is chromium.)

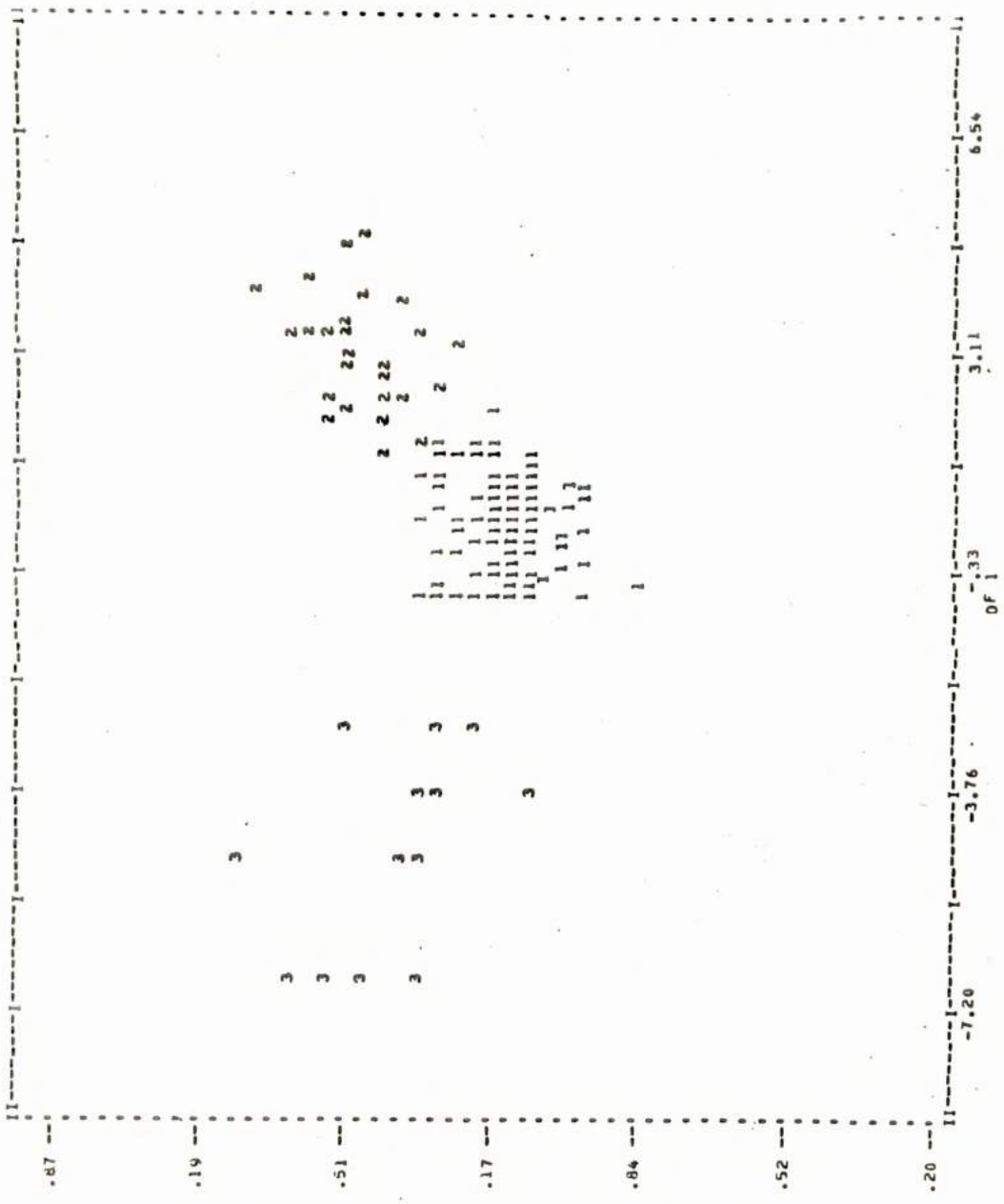
To understand more fully the results of the cluster analysis and the discriminant analysis, some additional work was done with the El Salvador reference

TABLE 8

Provenience Of Samples
In Reference Groups And Unallocated Specimens,
Final Allocation

	Reference Groups												
	Copan N=127			Motagua N=14			El Salvador N=26			Ungrouped N=73			Total
Provenience	C*	G**	Ch***	C*	G**	Ch***	C*	G**	Ch***	C*	G**	Ch***	
Copan Valley	43	9	3	-	-	-	-	-	-	10	4	8	77
Rio Amarillo	5	1	8	-	-	-	-	-	-	3	9	4	30
Western Honduras	48	10	11	-	-	-	-	-	-				
Chalchuapa	13	7	1	-	-	-	6	4	5	3	2	0	41
Zapotitan Valley	7	6	0	-	-	-	2	9	0	5	4	0	33
West and West Central El Salvador	20	13	1	-	-	-	8	13	5				
Quirigua	0	0	1	4	5	2				0	1	1	14
Lower Motagua	0	0	0	2	0	0				2	0	0	4
San Augustin Acasaguastlan	0	6	2	0	1	0				4	1	0	14
Motagua focus	0	6	3	6	6	2							
Naco Valley	-	-	-	0	0	-				0	0	3	3
Asuncion Mita	2	1	1	-	-	-				0	0	0	4
Pusilha	10	-	-	-	-	-				9	0	0	19
Tiquisate	1	-	-	-	-	-				-	-	-	1
Comparison Loci	13	1	1	-	-	-							
Total	81	30	16	6	6	2				36	21	16	240

*Copador **Gualpopa ***Chilanga



1. Copan-focus reference group
2. El Salvador-focus reference group
3. Motagua-focus reference group

Figure 11: Plot of Three Primary Compositional Groups Relative to Derived Discriminant Axes

TABLE 9

Standardized Discriminant Function Coefficients

Element	Function 1	Function 2
Rb	0.52	0.24
Cs	0.18	0.33
Ba	-0.21	0.07
Sc	-0.18	-1.20
La	-0.87	-1.35
Ce	0.79	1.15
Eu	0.89	0.15
Lu	0.30	2.25
Th	-0.67	-0.45
Cr	-1.19	0.24
Fe	0.65	0.97
Co	0.11	-0.25
Sm	0.18	-1.12
Yb	-0.84	-0.65
Eigenvalue	4.85	1.46
Percent of Discriminatory Power	76.9	23.1

TABLE 10

Major Group Mean Concentration[a]

Element	Copan-Focus Reference Group		El Salvador-Focus Reference Group		Motagua-Focus Reference Group	
	N=127		N=26		N=14	
La	24.10	(6.60)	21.60	(7.50)	23.00	(6.10)
Ce	51.80	(15.30)	50.60	(18.40)	44.50	(12.80)
Eu	1.16	(0.36)	1.16	(0.45)	0.97	(0.25)
Lu	0.50	(0.12)	0.55	(0.15)	0.50	(0.10)
Sm	5.28	(1.76)	5.28	(2.04)	4.40	(1.25)
Yb	2.94	(0.74)	3.11	(0.98)	2.83	(0.63)
Sc	18.20	(2.28)	15.90	(2.21)	18.10	(2.09)
Th	9.34	(1.34)	9.00	(2.10)	9.17	(1.54)
Cr	13.90	(3.10)	8.84	(2.20)	35.60	(9.90)
Fe	2.81%	(0.33)	2.89%	(0.49)	3.22%	(0.66)
Co	6.37	(4.90)	4.94	(2.50)	8.48	(11.20)
Hf	5.13	(0.64)	5.06	(0.88)	5.05	(0.37)
Rb	59.20	(15.60)	81.20	(24.60)	57.50	(21.60)
Cs	3.80	(1.26)	4.70	(1.51)	3.48	(1.23)
Ba	1360.00	(327.00)	1490.00	(338.00)	1570.00	(324.00)

NOTE: Concentrations are expressed as oxides in parts per million except for iron which is in percent.

[a]Numbers in parentheses represent one standard deviation.

group vis-a-vis the cases in the Copan-focus reference group. The ADCORR program was applied to the El Salvador group, determining Mahalanobis distance and calculating the probability via Hotelling's T^2 of Copan group cases being from the same population as the El Salvador group. It was found that 39 of the 127 Copan group members had projected probabilities of El Salvador group membership exceeding the 10 percent threshhold. If these samples were added to the El Salvador group and membership probabilities recalculated, additional samples would demonstrate high probabilities of belonging to the El Salvador group. Thus, the likelihood of overlapping membership is indicated. The significance of this finding will be discussed in more detail shortly.

To summarize the data at this point of the analysis, the cream paste ceramics divided as follows:

1. A large chemically defined compositional group with varying amounts of each type (more Copador than Gualpopa or Chilanga) weighted toward Copan provenience but also including ceramics from El Salvador, the Motagua Valley, the HondurasGuatemala border, and Belize (N=127).

2. A small similarly defined cluster including all three types and found at sites in the Motagua River Valley (N=14).

3. A small group of all three types found at sites in El Salvador. This group showed considerable overlap with Group 1 when the members of Group 1 were reviewed relative to Group 3 variance-covariance patterns (N=26).

4. Sherds of all three types from all proveniences that do not cluster with Groups 1 through 3 and that do not show any patterned variation (N=73).

CONCLUSIONS, CREAM PASTE CERAMICS

Localized Production

Given the observed division in the data what can be stated about the likelihood of these ceramic types being the result of localized resource procurement and production? First of all, a little further examination of the nature of the statistical separation among the clusters is necessary.

Copan-focus Reference Group Versus El Salvador-focus Reference Group

As previously mentioned, differences in mean concentrations of some of the elements being used in the analysis, while small (univariately varying no more than one standard deviation [Rb, Ba, Sc, Cr, and Co]), were statistically significant, as verified by the discriminant analysis. However, an overlapping membership was also found when Copan group cases were projected against the variance-covariance pattern of the El Salvador group. From the perspective of extensive analysis of Maya pottery (R. L. Bishop, personal communication, 1982) a logical conclusion is that the respective raw material sources for these two reference groups are not too far away from each other and could have served for the procurement of clay for localized pottery production.

Copan and El Salvador-focus Reference Groups Versus Motagua-focus Reference Group

The Motagua-focus reference group, consisting of Copador, Gualpopa, and Chilanga specimens from Quirigua, as well as Copador samples from the Lower Motagua survey and one Gualpopa sample from San Agustin Acasaguastlan, appears to be quite divergent from the Copan and El Salvador-focus reference groups. Although not presented in this research, the locally made Quirigua pottery, when projected onto the two discriminant axes, diverges in the same direction, only more strongly. That is, both the Motagua-focus reference group and the Quirigua locally made pottery diverge in a similar manner from the Copan and El Salvador groups (R.L.Bishop, personal communication, 1982). These data are not inconsistent with the hypothesis suggesting a separate raw material source and production area for the Motagua cream paste wares.

Ungrouped Cases

These specimens were carefully examined to try to determine if some undetected factors were affecting the chemical compositional data. At this point, however, a brief discussion of Chilanga is in order. Table 11 summarizes the cream ware types in terms of the proportion of each type that ended up in one of the reference groups versus remaining ungrouped.

While a similar proportion of both Copador and Gualpopa did not group, a larger proportion of Chilanga remained ungrouped. Since Chilanga has temporal priority over the other two types, this factor could be influencing the results. There could have been a change in the manner of resource procurement over time but not of production; there could have been a change in both resource procurement and production systems. It is not

TABLE 11

Allocation of Ceramic Samples
Clustered Versus Unallocated

Type	Clustered	Unallocated	Total
			N
Copador	72.5%	27.5%[a]	131
Gualpopa	70.0	30.0	70
Chilanga	59.0	41.0	39
			240

[a]without Pusilha: 22.1% (N=122)

possible to pinpoint the reasons for the observed differences but, because of them, Chilanga will be excluded from the ensuing discussion.

The following observations were made about ungrouped sherds from various proveniences.

1. Copan Copador (N=10). These specimens did not differ from the grouped pieces either in terms of location of excavated unit (site center or valley settlement) or vessel form (cylinders versus bowls).

2. Rio Amarillo Gualpopa (N=9). The lack of patterned variation is very noticeable in these samples from the site near Copan. Only one Gualpopa case achieved membership in the Copanfocus reference group. While a few of the Gualpopa samples exhibit greater iron concentrations relative to the Copan-focus reference group, other elemental concentrations vary univariately, negating hypotheses of a single, specific source.

3.. Pusilha Copador (N=9). The compositional variability observed in the pottery from this Belize site is difficult to evaluate. Approximately one half of the Copador samples fall near the centroid of the Copan-focus reference group. However, the remaining samples diverge dramatically and without a consistent pattern. Analyses of these samples were carried out on drilled powder supplied by the British Museum. Thus, it has not been possible to seek a mineralogical basis for the divergent compositions or to examine the actual sherd

material to see if all the specimens were standard Copador.

In addition to these observations, it was noted that at each site considered some Copador and/or Gualpopa specimens did not fit into the determined groups. This presents a baffling picture quite at variance with the sharper demarcations among resource procurement zones elsewhere in the Maya area (cf. Bishop, Rands, and Harbottle 1982; Rands and Bishop 1980; Bishop et al., n.d.b)

A conclusion from these findings is that Gualpopa and Copador production occurred mainly within one geographic area that utilized several quite similar clay resources (the Copan and El Salvador-focus groups) but that it was not a monopolistic type of highly controlled production system. Other producers with access to clays that fired white were also making ceramics which typologically were equivalent to the ones from the dominant source. Some of these producers may have had some kind of a production system organized for intersite distribution but on a smaller scale (the Motagua-focus group); others may have been very small producers (accounting for the ungrouped specimens) whose output did not enter into a regional distribution system.

Location of Main Production Area

The second topic to be addressed through the chemical compositional analysis was the locus for production that could be judged as having been localized. The approach to this question was through a comparison of trace elemental composition of cream paste ceramics and other ceramics of known provenience. On the basis of Copador's published occurrence, the Copan Valley was a likely candidate. In earlier work (Bishop et al., n.d.a) tentative compositional similarities were postulated between the cream paste ceramics and Copan's non-cream paste wares. Unfortunately, more detailed analyses subsequently demonstrated statistically significant chemical differences between the local Copan pottery and the cream paste ceramics.[6] These distinctions were verified by the determination of clay mineralogical differences.

Mineralogical information was gained by X-ray diffraction of pottery from the Copan Valley which, due to its abundance or duration in the ceramic sequence, is presumed to be of local manufacture. When pottery

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[6]In fact, statistically significant chemical differences were found between the cream paste ceramics and local pottery from the various sites in the study (Chalchuapa, Quirigua, and Zapotitan Valley).

is fired, there is a loss of water in the crystal lattice and an accompanying loss of crystal structure. Maya pottery tends to be low fired, well below the vitrification point and, over time, can rehydrate (Grim and Bradley 1948). Rehydration appears to be easier for some clay minerals such as illite and montmorillonite than for others like kaolinite. X-ray diffraction scans of the locally made Copan pottery revealed the presence of montmorillonite and mixed layer montmorillonite-illite clay minerals. Similar scans of Copador and Gualpopa pottery failed to reveal any peaks. These data, combined with the low iron concentrations of the cream paste pottery, are consistent with the hypothesis that a kaolinite clay was used (see Bishop et al., n.d.a).

Since the trace element pattern primarily reflects the clay composition, differences in the basic underlying mineralogy would preclude finding closely similar ceramic profiles. In the absence of similar ceramic wares believed to be of local manufacture, one is forced to rely on the Criterion of Abundance (cf. Bishop, Rands and Holley 1982) to establish the probable production area for the grouped cream wares. Given the percentage of pottery of a Copan provenience in the Copan-focus reference group, for the present one must heuristically regard that group as representing pottery made from raw materials obtained in the Copan Valley area. Additionally, a logical extension is that the El Salvador-focus reference group also was made from clays obtained in the same Valley area.

Some explanation for the compositional variation in the data set may be gleaned from a consideration of the nature of the clay deposits in the Copan Valley. Clays formed in the Copan Valley are derived from various lithological components, including limestones and sandstones as well as from units derived from volcanic activity. Some clays tend to be washed off the valley slope and deposited in low lying, flat areas. Other clays which are suitable for pottery are noted as occurring in isolated patches (Turner et al., n.d.). These isolated pockets of clay would be subjected to differential depositional history and weathering. Thus, the valley would provide a wide range of ceramic materials, including two with rather different clay compositions -- those formed from volcanic tuffs and those of sedimentary origins.

Isolated pockets of clay could also have affected the nature of the production unit. Perhaps a decentralized system of family units or smaller workshops located near the clay sources functioned more efficiently than would have large groups of specialists located farther from the major raw material.

The presence of quartz phenocrysts in some of the Copan Valley pottery, including the cream paste pottery, attests to the volcanic derivation of their raw materials. Additionally, Turner et al. (n.d.) note observing varying amounts of phenocrysts in contemporary pottery of the Copan Valley, another suggestion of similarity to the ceramic material under study. Consequently, it seems logical to postulate the geological possibility of a Copador clay source in the Copan Valley. The varying amount of phenocrysts in different pockets of clay could also explain the fine level variation in the trace element data being observed.

The accuracy of this hypothesis will be verifiable only through analysis of white-firing clays from the Copan Valley; that is, assuming Copador clay sources are extant and are located. It was not possible within the time frame of this research to do a field search with a geologist for clays in the Copan Valley. It is hoped, however, that such a project can be carried out in the near future so that a less conjectural conclusion can be drawn.

Inferred Production and Distribution Circumstances

At this point, a more detailed examination of the distributional pattern of the ceramics in the various reference groups offers some insights into possible production circumstances.

1. Pottery from Copan and Rio Amarillo falls either within the Copan-focus reference group or is ungrouped.

2. Pottery from El Salvador splits between the two closely allied reference groups of Copan and El Salvador; a residue is ungrouped.

3. Pottery from the Motagua splits between two more distinctly different reference groups -- Copan and the Motagua. Further, when specific provenience is checked, a variation among sites is observed.[7]

   a. Pottery from Quirigua (plus several specimens from the Lower Motagua) form the major part of the Motagua group.

   b. Pottery from the Middle Motagua site of San Agustin Acasaguastlan groups predominantly in the Copan group

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[7]Frequencies are lower so these observations must be more tentatively stated.

(one Gualpopa sherd fits with the Motagua cluster and five are ungrouped).

From these observations several inferences about resource utilization, production, and distribution can be made.

A restricted resource area (represented by the Copan-focus reference group) was being exploited for use in making ceramics for both internal consumption inthe Copan area and for export to El Salvador, San Agustin Acasaguastlan, Asuncion Mita, and Pusilha. A different source, although not too distant, was utilized by producers of other pottery that was exported to El Salvador. Such directed production and distribution were apparently in response to the needs of Chalchuapa, a conspicuous consumer of Copador and Gualpopa pottery.

A different source of raw materials was being used by producers whose cream paste ceramics ended up at Quirigua or Lower Motagua sites. At present, the location of a likely resource area for this pottery cannot be suggested. Wherever the location, given the low occurrence of Copador or Gualpopa ceramics at Quirigua and the Lower Motagua sites, the production center for this pottery was of secondary importance in comparison with the region producing the pottery for Copan and the other "export" sites.

An examination of the proportion of unallocated Copador and Gualpopa by provenience showed some variation between Western Honduras and El Salvador that could be suggestive of variation in a producing versus an importing environment. A given set of assumptions is as follows: 1) that the Copan Valley was the primary production center for the Late Classic cream paste polychrome ceramics and that the grouped specimens represent localized production within that area with distribution to other sites; 2)along with localized production and distribution, there were other smaller scaled producers who made similar appearing pottery for their own purposes or for limited distribution and that the ungrouped specimens represent their output. (One does not know where these smaller producers were. They could have been either in the Copan Valley or at other settlements where white-firing clays were available.)

Under this set of circumstances it is hypothesized that more of the pottery in the centralized production area would be from the smaller producers because the products from the large scale production would be more organized to move into export areas. Conversely, less of the pottery in an importing area would reflect the work of the small producer. If the "one potter shop" were in the Copan Valley, there would have been less likelihood that the few extra vessels

would travel outside the general area. If the small producer were within the importing area, there could have been resistance in terms of accepting the "imitation" or fewer potters with comparable skill or interest in copying the imports.

The data in Table 12 show that 21 percent of the El Salvador provenience cream paste types are unallocated to reference groups (represent smaller producers) while 31 percent of the samples from Western Honduras are ungrouped.

TABLE 12

Copador and Gualpopa Ceramic Samples
By Provenience -- Unallocated
Versus Grouped

Provenience	Unallocated	Grouped	Total N
Western Honduras (Copan, Rio Amarillo)	31%	69%	84
West and West-Central El Salvador (Chalchuapa and Zapotitan Valley)	21	79	68
Quirigua and Lower Motagua	21	79	14[a]
San Agustin Acasaguastlan	42	56	12[a]

[a] Small sample size should be noted when evaluating percentages.

The sample sizes for the two Motagua area proveniences are too small to add into this discussion except to say that San Agustin Acasguastlan looks more like a producing area (higher percentage unallocated) while the Lower Motagua - Quirigua area looks more like an importing area (lower percentage unallocated.)

Against this reconstruction of a Late Classic situation of both large scale production organized for regional distribution and independent, small scale production occurring simultaneously, several additional analyses were conducted: a review of the Zapotitan sherds by site, type, and groups; a review of the Chilanga data by compositional grouping by provenience.

Review of Zapotitan Materials

Ceramic samples from the west-central part of El Salvador came from excavations at two sites in the Zapotitan Valley. The Ceren site, an agriculturist's residence which had been destroyed by airborne volcanic materials from the eruption of a small nearby volcano, has been dated to 590 A.D. $\pm$ 90 (Sheets, 1983).

The nearby Cambio site consists of one large mound and four smaller mounds (Chandler 1978). Its stratigraphy shows several distinct occupational levels separated by layers of volcanic detritus. Two of the occupational strata are Late Classic, both of which post-date the volcanic eruption that destroyed the Ceren house (Zier, 1983). Thus, these two sites represent different parts of the Late Classic period -- Ceren being quite early, Cambio being later. The cream paste ceramics from the two sites show some interesting differences in terms of their reference group membership. (Only Copador and Gualpopa sherds from these two sites were analyzed; no Chilanga was encountered during the excavations. The Zapotitan Valley seems devoid of an early Classic occupation.)

Table 13 shows the allocation of ceramic samples from the Zapotitan Valley sites. Several differences among the samples can be noted:

1. More of the Cambio specimens group with the Copan-focus reference group while the majority of the Ceren pieces associate with the El Salvadorfocus reference group.

2. More of the Cambio pots remain ungrouped than do the Ceren pieces.

TABLE 13

Cream Paste Sherds From The Zapotitan Valley
By Site and Reference Group Allocation[a]

Allocation	Ceren (Earlier Occupation)	Cambio (Later Occupation)
Copan reference group	4	9
El Salvador reference group	8	3
Ungrouped	1	8
Total	13	20

[a]Frequencies rather than percentages are given due to the small size of the samples.

TABLE 14

Allocation Of Chilanga Ceramic Samples
To Reference Groups[a]

Provenience	Reference Group: Copan N	%	El Salvador N	%	Motagua N	%	Ungrouped N	%	Total N	%
Western Honduras (Copan & Rio Amarillo)	11	48	-	-	-	-	12	52	23	100
Western El Salvador (Chalchuapa	1	17	5	83	-	-	-	-	6	100
Quirigua	1	25	-	-	2	50	1	25	4	100
San Agustin Acasaguastlan	2	100	-	-	-	-	-	-	2	100
Comparison loci										
Asuncion Mita	1	100	-	-	-	-	-	-	1	100
Naco Valley	-	-	-	-	-	-	3	100	3	100

[a]Because of the small sample size, both frequencies and percentages are given.

A possible interpretation of these differences is as follows. In the earlier time period there was less competition, fewer "small time" producers as represented by the ungrouped specimens. At that time, more of the imported pieces came from the production source represented by the El Salvador-focus reference group. As time went on, more competition arose (an increase in the ungrouped segment) creating a shift in terms of the specific production source supplying the imported goods (more from the Copan-focus producers; less from the El Salvador-focus producers).

This interpretation must be tentative for several reasons. For one thing, the size of the samples from the two sites is small (Cambio 20; Ceren =13). Additionally, the sites represent different size classifications and probably different functional categories. Cambio, with its several large mounds, probably had some public role in the Valley socio-political structure. Ceren was the residence of an agriculturist whose milpa was adjacent to the house. Thus, the differences in the sources of cream paste ceramics could represent different nodes in the distribution and consumption system, as well as or instead of a temporal variation.

Review of Chilanga Materials

Several interesting points can be made when these earlier period ceramics are examined (Table 14):

1. In Western Honduras localized production is less prevalent than in the later period: 52.2 percent of the Chilanga vessels are not within the Copan-focus reference group while 31.0 percent of the Copador and Gualpopa specimens for the area had been ungrouped. (See Table 12.)

2. Chalchuapa also appears to have been an importing area during this time period : none of its Chilanga falls outside reference groups. (The frequency is very small, however.)

3. Although other proveniences lack enough cases to derive a pattern, one observation seems pertinent: one Chilanga sherd from Quirigua fit into the Copan-focus reference group. None of the Late Classic material from Quirigua had clustered with the Copan-based ceramics. While one case does not signify exchange, it is interesting to speculate that at a time period prior to the hypothesized political split between Quirigua and Copan (Leventhal 1980; Sharer and Ashmore 1979) cream paste

ceramics from the Copan Valley were traded to this Motagua Valley site.

FINDINGS, ARAMBALA CERAMICS

Introduction

The same basic series of data analyses was undertaken with red paste wares as with the cream wares. A total of 83 sherds comprised the analysis; materials included both thick wall domestic types and thin wall painted types from Chalchuapa and the Zapotitan Valley as well as Arambala sherds from both proveniences. (See Table 14.) Arambala paste is not as fine-textured as that of the cream paste painted wares. Thus, it was felt that a preliminary analysis could include a somewhat more diverse data set. Additionally, samples from a broader time span were used.[8] These ceramics represented different types within the ware classifications of Arambala as well as one of the dominant domestic types from the same Late Classic phase.

Preliminary Group Formation

Examination of a dendrogram produced through the BMD4M program showed several fairly well-defined clusters, one of which contained a majority of the Arambala specimens along with some of the Chalchuapa domestic specimens. The majority of the Chalchuapa domestic samples was clearly separated from the Arambala-based cluster, as was the majority of the Zapotitan Valley materials.

A Note About the Data Set

A factor analysis of the Arambala-based cluster was performed to evaluate the univariate and bivariate patterns in this data set and to examine the elemental loadings on the factors. Five factors emerged after Varimax rotation. This number of factors is somewhat larger than that usually encountered in data sets of fine paste ceramics from the Maya area.

The loadings on the rotated factors are shown in Table 15. The elemental loadings in Factors 1 and 2 lead to the interpretation that these factors derive from the nonclay inclusions in the ceramics. Factors 3 and 4 load on elements related to the composition of the clay itself. Factor 5 with its high barium loading may be reflecting the volcanic glass correlation described earlier.

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[8]The ceramic complex for each of the types is given in Table 4.

TABLE 15

Sorted, Rotated Factor Loadings
Red Paste Ceramics

Element	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Co	0.783	0.276	0	0	0.357
Lu	-0.763	0	0.397	0	0
Yb	-0.683	0	0.627	0	0
Cr	0.664	0	0	0.558	0
Ce	0.599	0	0	0.264	0.575
Fe	0.535	0.531	0.324	0.295	-0.310
Cs	0	0.873	0	0	0
Rb	0.438	0.765	0	0	0
Th	0	0.678	0	0.350	0
Eu	0	0	0.877	0	0
Sm	0	0	0.856	0	0
Hf	0	0.307	0	0.901	0
La	0	0	0.294	0.787	0.322
Ba	0	0.383	0	0	0.788
Sc	0	0.377	0.432	0	-0.689

NOTE: In this program, loadings less than 0.2550 are replaced by 0.

A conclusion drawn both from the number of factors and the pattern of elemental loadings is that this group of red paste ceramics represents a more complex data set than does the cream paste materials. These specimens are from a multicomponent system where elemental concentrations in both the inclusions and the clay matrix affect the data. (Factors 1 and 2, related to the inclusions and not the clay matrix, account for 55 percent of the variability in the data set.)

This inability to distinguish between clay component elements and inclusion elements also was noticeable in the intercorrelation matrix. It will be recalled that for the cream paste materials there were high intercorrelations among the rare earth elements which were concentrated in the clay component. For the

red paste materials, intercorrelations for the rare earths are not nearly as high; the rare earths load both with the particulate materials (probably ferruginous lumps) and with the clay.

The influence of the inclusion material on the overall chemical composition of this group of ceramics means that petrographic analysis would be essential to a thorough compositional assessment of the material. Since the red paste Arambala was of secondary interest to the current investigation, only a modest amount of additional work was undertaken.

Evaluation of Group Formation

The Arambala-based cluster was evaluated using the ADCORR procedures described earlier. Mahalanobis distances and probabilities of group membership were calculated. All the cases from the originally observed cluster were retained with a high level of probability. Additionally, other sherds were added with greater than a 10 percent probability of membership. Table 16 shows the final composition of the Arambala-focus reference group by provenience and type, as well as the provenience and types that did not group with the Arambala reference group.

No further attempt was made to cluster the remaining El Salvador sherds due to the limited number of cases, the complexities of the paste just described, and the varying temporal representation.

CONCLUSIONS, ARAMBALA CERAMICS

Of the Arambala samples analyzed, 75 percent had at least a 10 percent probability of membership in the Arambala-focus reference group. Thus, there is evidence of use of a common resource in the production of a significant part of the Arambala material. (The sample size must be kept in mind as a limiting factor, however. Only 24 Arambala sherds were subjected to neutron activation analysis.)

The Arambala cases represent one-half of the ceramics grouped into the "Arambala-focus reference group." The other members in the group are mainly sherds with a Chalchuapa provenience; only two are from the Ceren site in the Zapotitan Valley. Since so few non-Arambala sherds from the Zapotitan sites cluster with the Arambala group, it seems logical to conclude that the Zapotitan Arambala pots were not made there but were imported into the area.

The inclusion of Chalchuapa ceramics judged to be of local manufacture in the Arambala-focus group could suggest a Chalchuapa location for Arambala production -- vessels used at Chalchuapa as well as in the

TABLE 16

Sample Membership In The Arambala
Reference Group And Ungrouped Data

Type - Ware - Chalchuapa Complex	Arambala Reference Group			Ungrouped			
	Chalchuapa	Zapotitan	Total	Chalchuapa	Zapotitan	Total	Total
Arambala-Noj-Payu	10	8	18	3	3	6	24
Thin wall types							
Suquiapa-Noj-Xocco	1	-	1	2	-	2	3
Pajonal-Noj-Caynac and Vec	-	-	-	1	-	1	1
Tepeto-Ohl-Payu	-	-	-	6	-	6	6
El Pito-Boqueron Red[a]	-	1	1	-	2	2	3
Thick wall types							
Aquacate-Kan-Caynac and Vec	5	-	5	1	-	1	6
Guazapa-Kan (Boqueron Red)[a]-Vec,Xocco,Payu	3	1	4	8	17	25	29
Jujutla-Kan-Caynac and Vec	7	-	7	2	-	2	9
Huascaha-Ojushtal[a]	-	-	-	-	2	2	2
Total	26	10	36	23	24	47	83

[a]Zapotitan Valley assignment

Zapotitan Valley. However, the data analysis was not carried to the point where such a projection can be made with any strong degree of certainty.

Some questions remain to be answered before a more conclusive determination of the locus (or loci) of Arambala production could be made:

1. What is the significance of the observation that most of the Chalchuapa domestic sherds that fit into the Arambala-focus group are from earlier time periods?

2. Why do some specimens from the Chalchuapa types fit into the Arambala group and others of the same type show less than a 10 percent probability of belonging in the group? Were several different resources used for the non-Arambala types, one of which also was used for Arambala? Does the observed pattern reflect cultural practices or is it being unduly influenced by the application of the specific quantitative methods?

3. Would overlapping group membership be indicated if the Chalchuapa sherds that clustered on a different part of the dendrogram were used as a reference group and the Arambala sherds of various provenience were evaluated for membership? If the Chalchuapa materials constituted a unified reference group and if the Arambala cases regardless of provenience had greater than 10 percent probability of membership, the case for Chalchuapa as a production locus would be strengthened. If the Arambala divided by provenience then the case for Chalchuapa's production role would be weakened.

4. Would overlapping group membership be indicated if the Zapotitan domestic materials that clustered on a separate part of the dendrogram were construed as a reference group and the Arambala sherds evaluated for group membership? If the Zapotitan sherds showed the chosen probability for membership and if the Arambala cases of Zapotitan provenience could be added to the group, then the probability of Chalchuapa manufacture would be weakened. Similarly, if Arambala cases of both provenience showed probable membership in the Zapotitan domestic group, then the Chalchuapa hypothesis would not be supported. The conclusion from the latter

outcome would probably be that in this instance the analytic method is handicapped in its ability to establish distinctive "fingerprints." It is entirely possible that such a situation could result because of the prominent role of the inclusions in the chemical analysis.

Not only is there a need to perform additional analyses, it is also advisable to expand the sample size before attempting to resolve the issue of Arambala production. For the present, then, conclusions must be limited to these statements:

1. There is evidence for restricted resource utilization in the production of Arambala ceramics: a majority of examples of the type from three proveniences group together.

2. The chemical compositional characteristics of the Arambala materials do not match those of domestic ceramics from either Zapotitan site, suggesting that Arambala pots were imported to these sites.

3. The compositional characteristics of the Arambala of various proveniences correspond with some Chalchuapa domestic ceramic material thus raising the possibility of Chalchuapa as the locus of Arambala production.

SUMMARY

The majority of Late Classic cream ceramics (65.6 percent)-- Copador and Gualpopa -- was produced in one production area from which the vessels were distributed. The Copan Valley is assessed as being the most likely production zone. Several exceptions were noted:

1. Another production area, currently unlocated, provided a small amount of cream paste pottery to Quirigua and the Lower Motagua Valley settlements (6.0 percent).

2. Other potters, not using the same clay resources and probably operating on a small scale, also produced pots that stylistically were equivalent to those from the main production zone (28.4 percent). (See Table 17.)

TABLE 17

Locus of Late Classic Cream Paste
Ceramic Production

Locus of Production		Cream Paste Ceramics
		N=201
Main area		65.6%
Resource A	55.2%	
Resource B	10.4	
Secondary production area		6.0
Dispersed potters		28.4

These Late Classic cream ceramics were products of a mixed type of production system, mainly localized and exploiting restricted resources, but not so tightly controlled or administered that independent potters were precluded from producing similar pots. It seems that there were more of these small-scale operators within the main production area of Western Honduras than in the importing area of Western El Salvador.

Within the centrally produced material, most of the exported pottery and much of that consumed locally (in the Copan Valley and at Rio Amarillo) was made using raw material from one restricted resource area. However, a different clay resource in the same general area also was used for pottery made strictly for export to El Salvador (See Table 18).

Limited data from two El Salvador sites suggest possible changes in the production and distribution systems over time: an increase in competition from "small time" producers and a shift in production to the larger raw material source. Unfortunately, the size of the samples are too small to draw definite conclusions.

The picture obtained from the analysis of Chilanga, the cream paste ceramic that originated earlier than Gualpopa or Copador, is one of an earlier stage of incipient production organization and control. Only slightly more than half the vessels' paste corresponds to the restricted clay resource pattern. As in later times, western Honduras had more small-scale producers while Chalchuapa seems to be entirely an importing area.

Thus, there are several suggestions that through time the production of painted cream paste ceramics was moving toward increased organization for regional distribution but that the system had not become closed or monopolistic during the Copador-Gualpopa epoch.

TABLE 18

Provenience of Late Classic Cream Paste Ceramics by Locus of Production

Provenience	Main Production Area Resource A	Resource B	Secondary Area	Dispersed Potters
	(N=111)	(N=21)[a]	(N=12)[a]	(N=57)
Western Honduras	52.3%	-	-	45.6%
Western El Salvador	29.7	100.0%		24.6
Middle Motagua (San Agustin Acasaguastan)	5.4	-	8.3	8.8
Quirigua and Lower Motagua	-	-	91.7	5.3
Asuncion Mita	2.7	-	-	-
Tiquisate	.9	-	-	-
Pusilha	9.0	-	-	15.8
	100.0	100.0	100.0	100.0

[a]Small sample should be kept in mind when evaluating percentages.

The red paste polychrome, Arambala, was clearly produced from a different set of raw materials than the cream painted types. Even though the amount of chemical compositional analysis on these ceramics was limited, there is evidence that this pottery was made from raw materials found in a restricted procurement zone. It appears that the Arambala ceramics excavated at two sites in the Zapotitan Valley were imported since the compositional characteristics of the polychrome pieces do not match the domestic types from the sites. Some data suggest a distribution from the Chalchuapa zone but this cannot be stated with any certainty until considerably more work with the red-paste materials has been done.

CHAPTER 3

BACKGROUND FOR INVESTIGATION OF THE PRODUCTION SYSTEM

INTRODUCTION AND THEORETICAL CONSIDERATIONS

From the chemical compositional data presented in Chapter 2 it was concluded that several closely located resource zones had provided clay for a majority of the Copador and Gualpopa pottery specimens and that these vessels, found in various proveniences, were a result of material exchange. The next hypothesis to be tested was that the ceramics had been made within a system of specialized pottery production geared to standardization and simplification.

A qualitative assessment of Copador's decoration suggested a production system in which a fairly large quantity of standardized and simplified vessels conforming to certain stylistic canons was manufactured. This assessment was based on such observations as:

-- The manner of painting on Copador vessels is bold and freely rendered in a cursive style. The impression is of a general effect rather than a precise, carefully detailed product. Familiarity with the designs is also suggested. This overall effect, observed by earlier archaeologists, had been assumed to be a product of a small group of artisans (Longyear 1952:60).

-- A few design motifs seem to dominate the decorative scheme, conveying the idea that a limited repertory of motifs was repeatedly used rather than unique designs having been created. In fact, these easily recognizable designs constituted one of the bases for initially classifying the ceramic type.

-- The aesthetic quality of the decoration and the repetitive motifs do not suggest objects with "one-of-a-kind" value such as would be stressed in gift exchange. This type of social function is also questionable because of the quantity of Copador uncovered in a variety of contexts (see Chapter 6).

The goal of this part of the research, therefore, was to develop quantitative methods for evaluating the extent of standardization and simplification present in the ceramic types.

It was believed that characteristics of the production system could be quantitatively assessed through the result of production decisions, reflected in attributes of the finished ceramic vessel. For instance, standardization assumes that a consistency will be achieved in terms of the results at various decision stages. A limited number of producers, perhaps specialized by production step, assumes that a stong modal tendency within the observed consistent decision will result. Simplification assumes that a cost efficient alternative will be selected at the decision points.

Production decisions were grouped according to the stages in the process when they are made:

1. Decisions made before the vessel was formed -- vessel category, sidewall direction, base, special shape considerations, rim diameter, height, thickness

2. Decisions about materials needed for decorating -- slip color, paint colors on the entire vessel.

3. Decisions about composition, that is, spatial division of the exterior and interior design fields -- rim, wall, exterior wall/base juncture, and interior wall/interior bottom .

4. Decisions about the content and execution of the decoration of the spatial divisions -- motifs and frequency of repetition by register, exterior and interior; paint colors by register; motifs on interior bottom; decoration of exterior base.

These four groups of production decisions were evaluated in order to make inferences about ceramic standardization and simplification, as well as other production circumstances. Additionally, an evaluation was made of technical competence from:

-- Luster (reflects the degree of polishing originally achieved but is affected by depositional history).

-- Smearing of paint (an indication of whether polishing was done too soon after painting).

-- Craftsmanship (appraisal of care in executing painting -- evenness and fineness of line width, carefulness in filling outlined areas, detail in executing design, etc.).

METHODOLOGY

Data Base

The production-decision analysis used only whole or partial vessels where it was possible to determine the overall configuration of the vessel and its decoration. Most Copador vessels are decorated on both interior and exterior surfaces. The designs, for the most part, are discrete or finite rather than continuous. Thus, it seemed that important information would be contained in the manner in which design motifs were combined rather than from simple frequency of use of individual motifs. For this reason, only materials which could provide data about overall design configuration were analyzed. Recording was done for vessels stylistically classified as Copador, Gualpopa, Chilanga, and Arambala.

Comparison groups were included for the following reasons:

Gualpopa. Chemical compositional analysis had indicated a pattern of resource utilization similar to that for Copador. It could be expected that the two types were products of a similar production system and would show similar levels of standardization in decoration. Gualpopa seems to have a slightly longer production span since it is found in Middle Classic contexts.

Chilanga. This type appears in the archaeological record earlier than Copador or Gualpopa but continues into the same Late Classic period as the other two cream ware types. Its chemical composition is more diverse, suggesting less control and less standardization in its production process. The longer time span could also have led to the utilization of different clay sources which would be reflected in the less homogeneous chemical composition.

Arambala. This red paste type seems derivative of Copador in terms of its modal shape and its design motifs. As a "copy" it is expected to show a high degree of standardization in its decorative aspects. It is conjectured that, as a reproduction of a borrowed style, this ceramic would be less open to experimentation in designs. There would be a more rigid following of decorative "rules" to ensure that consumers would accept the substitute as being as good as the "real thing."

Table 19 shows the composition of the vessel sample available for the production-decision analysis.

TABLE 19

Vessel Shapes[a] By Types

Type	Copador	Gualpopa	Chilanga	Arambala	Total
	N=167	N=63	N=41	N=37	N=308
Bowls, total	126	46	25	36	233
Open	46[b]	39[b]	16[b]	7	108
Recurred	67[b]	7	8	26[b]	108
Markedly incurving walls	5	-	1	1	7
Flared or outcurved walls	8	-	-	2	10
Cylindrical shapes, total	32	16	10	1	59
Vases	28[b]	12[b]	6	1	47
Cups	4	4	4	-	12
Jars	7	1	2	-	10
Low open shapes, total	2	0	4	0	6
Dishes	2	-	3	-	5
Plates	-	-	1	-	1

[a]See Appendix E for dimension criteria used in classifying vessels into these shape categories.
[b]Used for analysis of early production decisions; may have been dropped for subsequent analyses.

The types are shown divided by vessel shape. As will be explained in more detail shortly, all the analyses were carried out within a vessel shape category.

Terminology

Throughout this chapter certain terms will be used when describing the designs, recording, and analysis. The major terms are defined in Appendix D to clarify the manner in which they are being used.

Recording Procedures

A recording form to cover the attributes resulting from these production decisions was developed, experimented with, and revised for field use. Coding

categories for machine processing were used. (A copy of the form and the coding outline are included as Appendix E.)

It was recognized that design motifs, a key aspect of the analysis, could be handled at several levels of detail. For example, a frequently used motif is one that Longyear (1952) first described as Glyph A (Figure 12)[9]. This motif is easily recognizable on both interior and exterior vessel designs. However, Glyph A is rendered in a number of different ways: 1) with the main sign on the right, 2) with the main sign on the left, 3) with only the main sign, and 4) with details that lead to its being classified as a "variant." Additionally, different color combinations are employed: 1) black outline with orange fill, 2) red outline with orange fill, and 3) black outline only. Since the goal of the analysis was to examine variability, it was felt that these details should be preserved in the recording procedure. Thus, a different code was used for each specific rendering of the motif. Appendix F contains the motif catalog with motifs grouped according to type of design. The verbal description of the abstract designs follows that used by Smith (1955) wherever possible.

The procedure was to record all data about an individual vessel using the collection or museum number as its identification. Then a photographic record was made of the piece in both black and white and color. Color was used to give an overview of the vessel (interior and exterior), its shape and general design configuration. Black and white film was used to provide a detailed record of the vessel's decoration which would be usable in making roll-out drawings of each piece. This entailed photographing to the same scale the entire pot, section by section, overlapping the shots so that the undistorted center of each frame could be traced in the roll-out process. Both the interior and exterior surfaces were photographed in this manner. Table 20 lists the locations at which vessels were recorded. Table 21 shows the provenience by shape of the vessels that were recorded.

The 167 Copador vessels recorded during this research represent a significant proportion -- probably a majority -- of the existing whole Copador vessels. However, this group cannot be assumed to be a random sample of the universe of Copador produced. The coverage of the comparison types is less thorough, as the total numbers would suggest.

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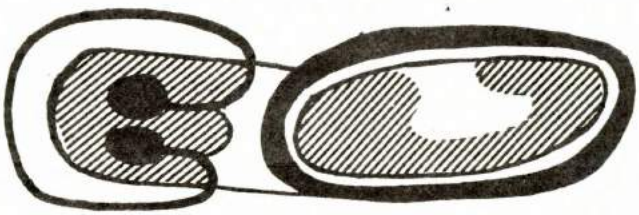
[9]The convention used for designating paint color in this and the rest of the illustrations is:



A. Main sign on right

B. Main sign on left

C. Main sign only

D. Variant

Figure 12: Variability in Motif Glyph A

TABLE 20

Locations Where Vessels Were Recorded
For Production-Decision Analysis

Honduras

Copan Archaeological Project headquarters, Copan
Copan Museum, Copan
Instituto Hondureno de Antropologia e Historia, Teguciagalpa
Banco Atlantida, Tegucigalpa
Comayagua Museum, Comayagua
Private collections, San Pedro Sula

Guatemala

Museo Nacional, Guatemala City
Museo Popol Vuh, Guatemala City
Private collections, Guatemala City

El Salvador

Museo Nacional, San Salvador[a]

United States

Peabody Museum, Harvard University
Smithsonian Institution, Washington, D.C.
University Museum, University of Pennsylvania
UCLA (collection from the Protoclassic Project, El Salvador)

a) In addition to recording at the National Museum, use was made of slides of pieces in the Museum's collection which are not currently accessible. The slides had been taken as part of Sharer's Chalchuapa project and were made available to him. Since they included a scale, it was possible to take most of the measurements needed for recording purposes.

TABLE 21

Provenience By Shape Of Vessels
Examined For Production-Decision Analysis

Vessel Shape	Copan	Other Honduras	Western El Salvador	Motagua & Asuncion Mita	Other Guatemala	Unknown	Total
Copador							
Open bowls	26	1	6	-	2	11	46*
Recurved bowls	37	5	11	6	1	7	67*
Vases	14	6	-	2	-	6	28*
Bowls-markedly incurving	1	-	1	-	1	2	5
Bowls-flared walls	-	-	1	-	1	3	5
Bowls-outcurved walls	1	-	-	-	1	1	3
Dishes	1	-	-	-	-	1	2
Cups	2	2	-	-	-	-	4
Jars	5	-	1	-	-	1	7
Plates	-	-	-	-	-	-	-
Total							167
Gualpopa							
Open bowls	9	1	19	3	1	5	39*
Recurved bowls	1	-	5	1	-	-	7
Vases	5	1	1	3	2	-	12*
Cups	3	1	-	-	-	-	4
Jars	1	-	-	-	-	-	1
Total							63

TABLE 21 (continued)

Vessel Shape	Copan	Other Honduras	Western El Salvador	Motagua & Asuncion Mita	Other Guatemala	Unknown	Total
Chilanga							
Open bowls	7	2	2	2	3	-	16*
Recurved bowls	6	1	-	1	-	-	8
Vases	2	-	-	3	1	-	6
Bowls-markedly incurving	1	-	-	-	-	-	1
Dishes	1	-	1	1	-	-	3
Cups	4	-	-	-	-	-	4
Jars	1	1	-	-	-	-	2
Plates	1	-	-	-	-	-	1
Total							41
Arambala							
Open bowls	-	-	7	-	-	-	7
Recurved bowls	-	-	11	4	4	7	26*
Vases	-	-	-	1	-	-	1
Bowls-markedly incurving	-	-	1	-	-	-	1
Bowls-flared walls	-	-	2	-	-	-	2
Total							37

*Used for analysis of early production decisions; may have been dropped for subsequent analyses.

Extensive examination of sherd lots was also undertaken in an attempt to assess the general representativeness of the whole vessel samples. This work included reviewing material at the Peabody Museum from both the earlier (Gordon 1896) and recent Harvard Copan Valley Project; at the Copan Project Headquarters in Honduras, from the currently ongoing project; at the National Museum in Guatemala City from San Agustin Acasaguastlan, Asuncion Mita, and Rio Hondo; at the University of Pennsylvania from the Chalchuapa project; and at UCLA from the La Canteada, Honduras, and Zapotitan Valley, El Salvador projects. Additionally, a frequently used reference was the published Chalchuapa ceramic sequence (Sharer 1978a Vol 3) which has some quantified data for the various types based upon extensive stratigraphic work and augmented by the collection of whole vessels from earlier work at Tazumal (Boggs 1950).

From this work it was concluded that the whole vessel samples do include the range of variability in shaping, decoration, and technical competence present in the much larger sherd samples. The sherd samples did not uncover any additional shapes or design motifs which had not been recorded from the whole vessels. Thus, while conclusions reached on the basis of any nonrandom sample must be considered tentative, the whole vessel samples seem to be acceptable for the purposes for which they will be used.

Techniques of Data Handling

Once the recording was completed a data file was created on the UCLA WYLBUR system for cases in each of the vessel shapes within each type. Various researchers have pointed out the interrelationship of form and decoration (Fry and Cox 1974; Plog 1978, 1980; Shepard 1971b; Watson 1977). Thus it would be important to control the variable of shape when examining decoration. Because of the necessity to hold shape constant, it was not possible to include a number of the small sized shape samples in most of the analyses. The shapes used for at least the earlier parts of the work are noted in Table 19.

The complete set of variables,[10] both discrete and continuous, was entered into the data file for each case. Runs were made of BMDP2D to obtain a frequency distribution and descriptive statistics for each variable. A total of 112 variables was accounted for on the recording form. Many of these, of course,

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[10]Throughout this research the term "variable" is used to mean a certain attribute that can be determined or measured. The term "variable state" is used to mean the actual value determined or measured for the variable in a particular case.

were present on only a few vessels. For example, provision had to be made for recording information on as many as four exterior registers because a few vases used that many horizontal divisions.

Similarly, color and width of as many as three bands between each register and between the rim and the first register had to be accommodated because they were observed on a few vessels. However, the initial computer tabulations showed that many of these variables would not be useful in working with the data grouped as it needed to be. There were too few cases representing some of the variables or numerous variable states were scattered over the moderate number of cases in a file. Following an examination of the frequency distribution of each variable, a significantly reduced set of variables was selected for continued use in the analysis.

In terms of the motif related variables, the amount of detail preserved in the original coding proved to be counterproductive in that too many attri- bute states resulted. In itself this was an interest- ing preliminary finding; even though motifs were consistent, specific executional details and combinations were variable.

Nevertheless, in order to derive subsamples of a sufficient size for statistical analysis, motif combinations were reduced in number. For example, on Copador open bowls, all renditions of Glyph A (facing right, facing left, main sign only, etc) were grouped together as one variable state, Glyph C was treated similarly, Glyphs A and B used together, etc. This step resulted in between nine to fourteen variable states for motifs in the various registers of the different shapes. Given the number of cases in each shape category, the result still was a very dispersed distribution. Consequently, a further reduction was made which resulted in more broadly based variable states, four or five per motif variable. This aspect of the data will be discussed in more detail in the chapter dealing with the content of the painted decoration.

ORGANIZATION OF THE FINDINGS

As mentioned, the production process was conceptualized as consisting of a number of decisions. These decisions would be influenced by the circumstances within which the ceramics were being made and would be reflected in attributes of the finished vessels. Thus, by recording and analyzing various attributes of the pottery, inferences can be made about factors operating in the production system.

Decisions made during the shaping and prepara- tion of the vessel prior to decoration is the focus of

Chapter 4. Shape categories, vessel dimensions, materials needed for decoration (slips and paints), and spatial orientation toward the design field will be examined to evaluate the extent to which these production decisions indicate standardization and simplification. That chapter also will evaluate the technical competence observable in the finishing process and the painting as a further assessment of the level of craftsmanship operating in the production system.

Decisions about the content and the execution of the decoration are examined in Chapter 5. These data are analyzed from two viewpoints: system-wide standards indicating homogeneity of the symbolic value of the decoration and production unit standardization indicating the degree of physical centralization of production and the number of producers in the system.

CHAPTER 4

PRODUCTION DECISIONS: SHAPING AND PREPARING THE VESSEL FOR DECORATION

INTRODUCTION AND OVERVIEW

Standardization and simplification are two expected manifestations of specialization for nonelite distribution. Both of these characteristics can be assessed from decisions made at various stages in the production process. In this chapter decisions area considered concerning shapes to construct, dimensions of the different shapes, materials selected for decoration, and organization of the vessel's space for decoration. The hypothesis is that, if production goals were to achieve a standardized, simplified product, the commodity was intended for use in a nonelite distribution system. These production objectives would relate to the market requirements for the ceramics, reflecting their value as an exchange item and their societal role.

Simplification and standardization may also reflect production organization. In recent work related to tracing the development of ceramic specialization through standardization, Rice (1981) set forth the following expectations for distributions of technological or stylistic characteristics of pottery whose production is limited and in the hands of specialist producers: 1) distribution curves will skew and have a narrow peak, 2) the curve will be multimodal and can be broken into smaller distributions which will skew and/or be kurtotic, or 3) "both of the above may be true" (ibid:221). She continues by saying that "unimodality may indicate the degree of consistency in achieving a desired effect; multimodality may reflect the existence of multiple producers...." (ibid:221).

Data related to the various production decisions necessary in terms of shaping and preparing the vessel for decoration were tabulated and the distributions evaluated from the viewpoint of standardization and simplification. Detailed presentation of the findings will be given in the following sections. Table 22 summarizes the conclusions regarding standardization by vessel shape and type. Several results are noteworthy:

1. The degree of standardization is not consistent within a ceramic type. Copador open bowls are more standardized than Copador recurved bowls. Both of the bowl shapes, in turn, are more standardized

TABLE 22

Degree Of Standardization Evaluated
From Variable Distribution Analysis

Production Decision	Standardization						
	Copador			Gualpopa		Arambala	Chilanga
	Open Bowl	Recurved Bowl	Vase	Open Bowl	Vase	Recurved Bowl	Open Bowl
Vessel shaping							
Dimensions	Yes/ strong	Yes/ medium	No	Yes/ medium	No	Yes/ medium strong	No
Decorating materials							
Slips	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Paints	Yes	Yes	No	Yes	Yes	Yes	Yes
Spatial division organization							
Exterior	Yes/ strong	Yes/ medium	No	Yes/ medium	No	Yes/ 2 modes	Yes/ medium low
Interior	Yes/ strong	Yes/ medium	No	No/both decorated & undecorated	Not decorated	Medium	Yes/ not decorated

than Copador vases. A similar variation is noted between the Gualpopa open bowls and Gualpopa vases. Thus, stylistic comparability cannot be assumed to reflect equivalent production objectives.

2. Copador and Gualpopa vases were not standardized on the characteristics evaluated. Since the paste compositional analysis had not indicated any differential grouping by vessel category, the raw material for the vases was not distinguished by a different procurement process. It is possible that this vessel category represents "special orders" or some functional distinction which sets it apart from the bowls in terms of standardization. (Handler [1963], describing pottery making in Barbados, relates how a handful of standardized forms is produced in various sizes. However, special orders for other items are accepted from customers who came to the village and explained to the potter what they wanted [ibid:323].)

3. Chilanga open bowls show only a marginal level of standardization. Vessel dimensions are not very standardized and the exterior spatial divisions show considerable variability. Based on this series of production decisions it appears unlikely that Chilanga ceramics were made with the goal of standardization.

Simplification was assessed for the criteria of vessel category shape and variety of paints used as decorating materials. All four painted types emphasize simplified vessel shape. Only three shapes dominate across the various types. In terms of the paints used, a simplified array of colors was used in all cases except on a subgroup of Copador vases which showed elaboration in the variety of paints applied.

The data from evaluations of technical competence indicate that Copador vases received the most care in polishing and attained the highest level of craftsmanship. Both open and recurved Copador bowls show an intermediate level of care in finishing and craftsmanship which seems compatible with the hypothesis of standardized, simplified production. In general, Gualpopa and Arambala bowls rank lower than Copador vessels on these characteristics.

From this series of production decisions, one would conclude that standardization was a production

goal in the case of both bowl shapes in the three polychrome types -- Copador, Gualpopa, and Arambala. Standardization was most clearly achieved in the case of the Copador open bowls. Conversely, both Copador and Gualpopa vases do not reflect standardization. The significance of these findings is discussed in conjunction with the data from the decoration-related production decisions.

FINDINGS: DECISIONS REGARDING VESSEL SHAPE

Category

Summary

The data on vessel shape for all four of the painted types are compatible with the hypothesis of a standardized production process with an emphasis on simplification. Only three shapes dominate across the various types. One, the open bowl, is an extremely simple shape without elaboration of any type, capable of being produced in molds or by the least complicated hand construction process. Vases require somewhat more attention in the shaping process but still cannot be considered very elaborate. The recurved bowls show somewhat more elaboration. Variation is found in the shape of the vessel above the angle and some bowls have faceted flanges or grooving below the curve. A few effigy shapes are modeled in the lower register. This elaboration is not so extensive nor so finely detailed as to refute the basic conclusion, however.

Detailed Findings

Vessel shapes by frequency of observation are shown in Table 23. As mentioned earlier the whole vessel sample is not random. The distribution of the types by shape probably is one of the less secure features of the data; consequently only some general observations will be made.

Copador. Three shapes clearly represent the main manufacturing modes: recurved bowls (40.1 percent), open bowls (27.5 percent) and vases (16.8 percent). The other 15.6 percent of the sample is spread over an additional five shape categories. (Chalchuapa data support the three modal shapes as being the most frequently encountered forms.)

It is interesting to speculate that the nonmodal shapes were made by specialist potters for their own domestic use or under other unique circumstances that encouraged nonstandard shapes. Provenience data does not strictly confirm this possibility but does offer some interesting suggestions. Ten of the 26 vessels in these varied shapes were found in the Copan Valley. The more specific Copan Valley provenience was checked

TABLE 23

Vessel Shapes By Frequency Of Observation

Vessel Shape	Copador	Gualpopa	Chilanga	Arambala	Total
	N=167	N=63	N=41	N=37	N=308
Recurved bowls	40.1%	11.1%	19.5%	70.3%	35.1%
Open bowls	27.5	61.9	39.0	18.9	35.1
Vases	16.8	19.0	14.6	2.7	15.3
Jars	4.2	1.6	4.9	-	3.2
Bowls with markedly incurving walls	3.0	-	2.4	2.7	2.3
Bowls with flared or outcurving walls	4.8	-	-	5.4	3.2
Cups	2.4	6.3	9.8	-	3.9
Dishes	1.2	-	7.3	-	1.6
Plates	-	-	2.4	-	.3

for these shapes. The five jars found (four of which had shape elaboration in the form of effigies) were in special contexts -- two in Valley-located burials (without tomb construction), two in stela caches in the Center, and one in an unspecified context but within the Center area. The five other nonstandard shaped vessels from the Copan Valley were two bowls, two cups, and one dish. With the exception of one cup from a Valley tomb, these vessels were in construction-related fill either in the Valley or Center residential context. Thus, the nonstandard shapes could represent pieces made both for special domestic and special ritual use. Unfortunately, the remainder of the atypical shapes have only very generalized or unknown provenience, so more definitive conclusions can not be reached.

Gualpopa. A very strong modal form is the open bowl (61.9 percent) which most frequently has a convex rather than a flat base. Sharer at Chalchuapa reports only three shapes for this type, with the convex base, open wall bowl being the most common (1978a Vol 3:51). It is mentioned in passing that four of the five nonstandard shaped vessels in this type have Copan proveniences.

Chilanga. The open bowl shape with a convex base is also the modal shape for Chilanga as well as for Gualpopa. Although the mode is not as dominant in the whole vessel Chilanga sample as that of Gualpopa (Chilanga 39.0 percent; Gualpopa 61.9 percent), Sharer reports it at Chalchuapa as being the most common Chilanga shape (1978a Vol 3: 47).

Arambala. A recurved bowl shape is by far the most frequently used form for Arambala pots (70.3 percent). Another shape, a small restricted neck jar, is reported at Chalchuapa (Sharer 1978a Vol 3:56) but was not encountered in the whole vessel sample.

Dimensions

Summary

Several groupings do not reflect significant standardization of dimensions: Copador and Gualpopa vases, and Chilanga open bowls. For the other shape types there appear to have been multiple producers (multimodality observed) working under varying conditions of standardization:

1. Potters shaping Copador open bowls -- strong standardization

2. Potters shaping Arambala recurved bowls -- medium/strong standardization

3. Potters shaping Copador recurved bowls and Gualpopa open bowls -- medium standardization.

Detailed Findings

Height, rim diameter, and wall thickness (measured about 3 cm below the lip) were tabulated for the shapes identified in Table 19 in the preceding chapter. Measurements were rounded to the nearest centimeter or, in the case of thickness, millimeter. Histograms prepared from the tabulations are shown as Figures 13 through 16.

Rice's expectations regarding the distribution of attributes of pottery whose production is limited to specialized producers (see page) were used as a framework for evaluating the histograms of the measurements.

Copador Vessels (Figure 13)

Open Bowls. Vessel height and thickness distributions each show a decided skew with a fairly narrow peak, thus supporting the idea of standardization being reflected in the "degree of consistency in achieving a desired effect." The thickness characteristic with a

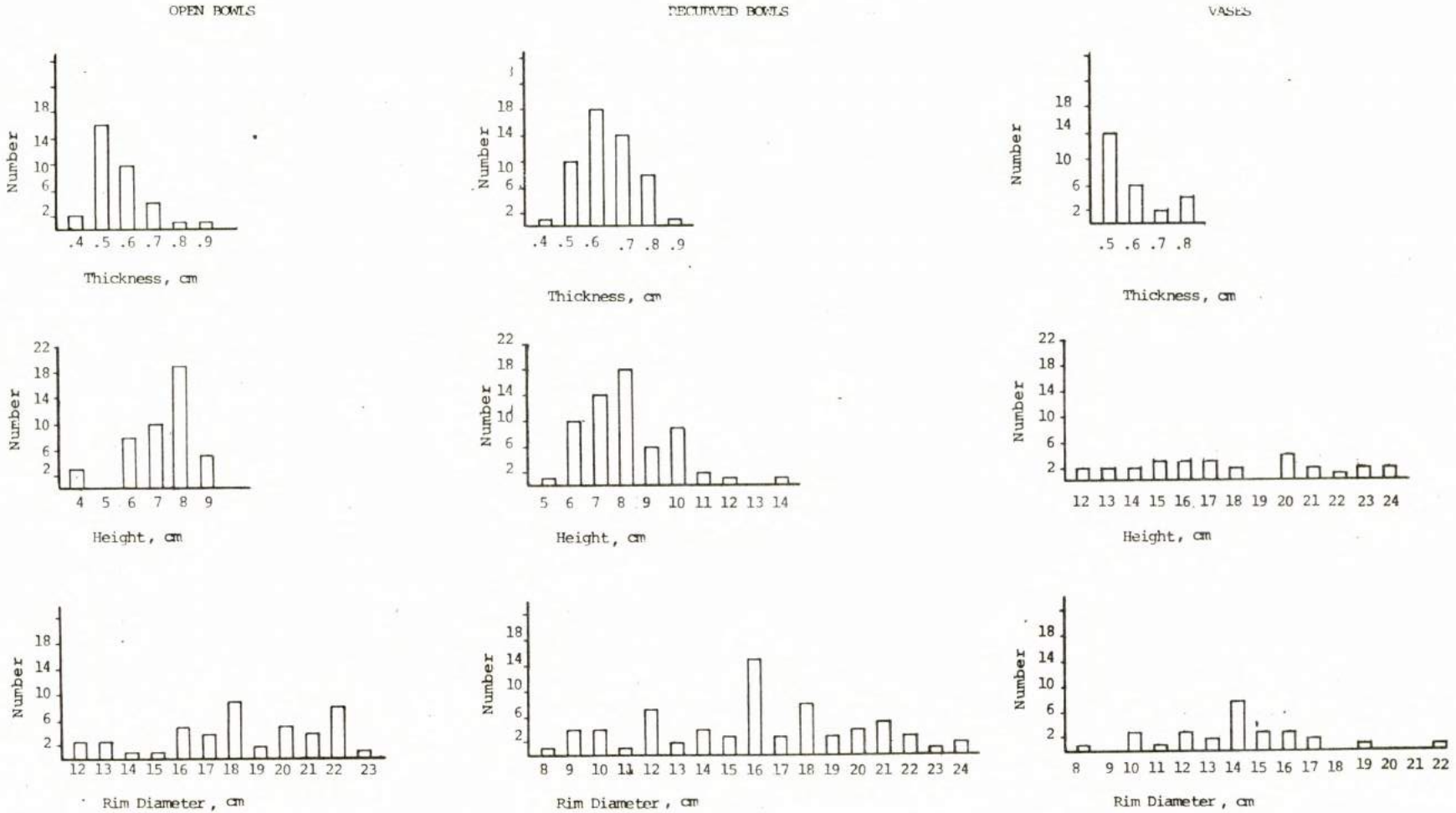


Figure 13: Histograms of Vessel Dimensions, Copador Shapes

strong mode of 5 mm would appear particularly susceptible to such an orientation. Rim diameter, on the other hand, appears bimodal (18 and 22 cm) with distribution skewed but not steeply peaked. This generally fits the expectation for multimodality reflecting the presence of multiple specialized producers.

Recurved Bowls. Thickness again showed a unimodal distribution with a relatively strong central tendency (6 mm). Height has a broader distribution than for the open bowls (recurved bowls, 5 cm to 14 cm; open bowls, 4 cm to 9 cm) and a less pronounced kurtosis. Rim diameter has a broad curve with three moderately defined modes at 12, 16, and 18 cm. This pattern of distributions suggests the technical competence of specialists in achieving a consistent wall thickness but with various production units using slightly different standards for their pots' height and rim diameters. Thus, the presence of multiple specialized producers is supported but the degree of standardization seems less marked.

Vases. Rim diameter and height have very broad and generally flat curves (rim diameter: 8 cm to 22 cm; height: 12 cm to 24 cm) although a minor peak occurs in the rim diameter measurement at 14 cm. Thickness, as with the other shapes, is carefully controlled (mode 5 mm, range: 5 mm to 7 mm). Vases appear definitely not to have been made in production formats that aimed at a standardized product.

Gualpopa Vessels (Figure 14)

Open bowls. The distributions for rim diameter and height show marginally wider ranges than did the Copador bowls of this shape. However, a fairly marked single mode for the rim diameter was present, with the same value, 18 cm, as the stronger of the two Copador modes. Height seems to reflect two modes, but since they are only 2 cm apart (6 cm, 8 cm) it is probable that there really is only one broader peak in the curve. Thickness is quite controlled (mode 5 mm, range: 4 mm to 8mm). The conclusion from this set of data is that production took place under some degree of standardization that was less controlled than with Copador. A complicating factor of time control must be mentioned here. Gualpopa appears to have been manufactured for a longer time than was Copador. Thus, there may be more built-in variability in the Gualpopa due to a shifting tradition (and production system over time.

Vases. (The frequency is very low, N=12, so the observations may be influenced more by sample size than by actual distributional patterns.) All the dimensions have a narrow range (height: 12 to 19 cm; thickness: 5 to 7 mm; rim diameter: 10 cm to 16 cm). There is no strong modality except for thickness (5 mm). If these

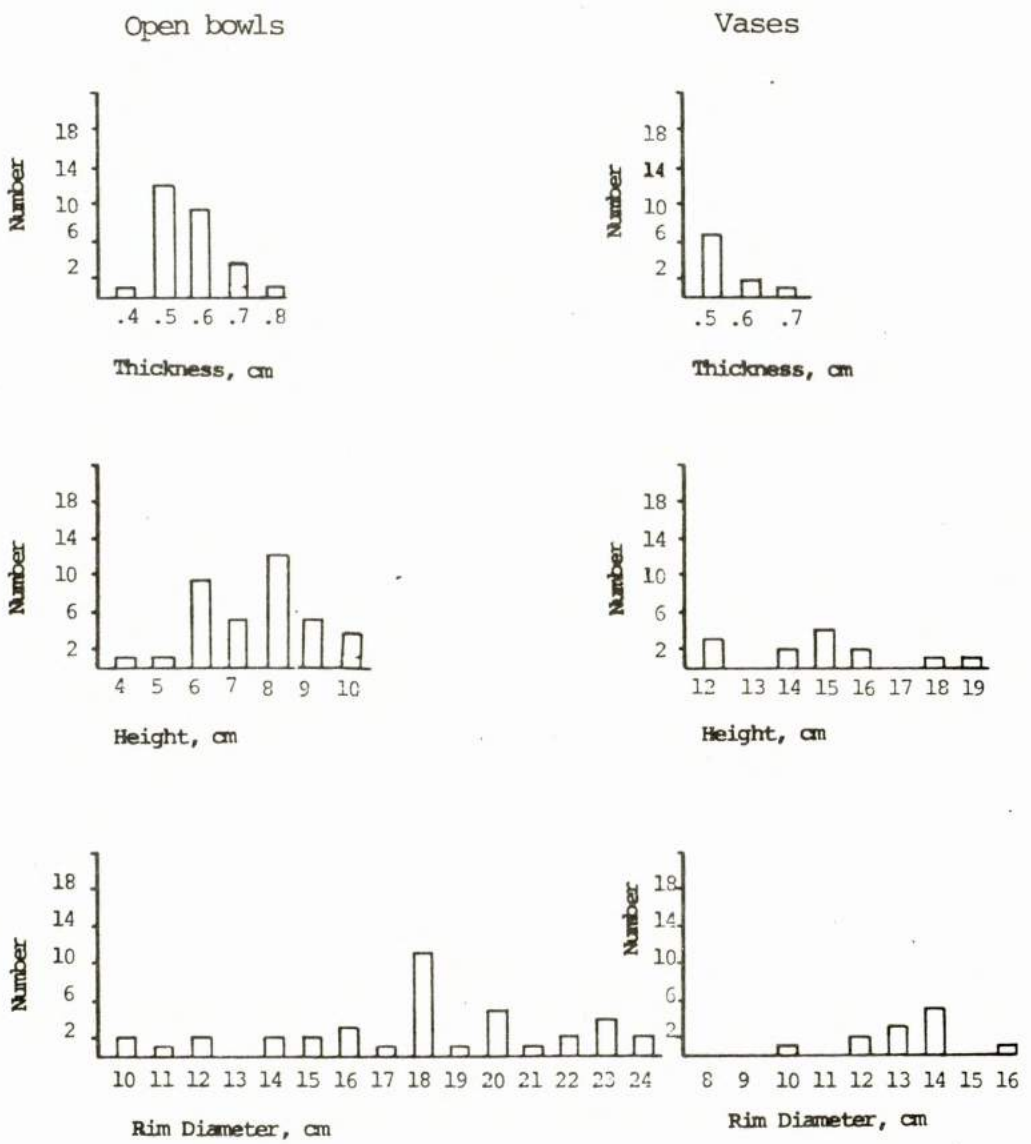


Figure 14: Histograms of Vessel Dimensions, Gualpopa Shapes

patterns were verified in a larger sample, we would conclude that, like Copador vases, Gualpopa vases were not intended to be standardized products.

Chilanga Vessels (Figure 15)

Open Bowls. The limited size of this sample, N=16, precludes any definite conclusions but general observations can be made. Even with the small number of cases, the spread of thickness measurements is the widest for any vessel group examined (4 to 10 cm). This would argue for less consistency in achieving a desired effect, less specialization. The broad, flat curve for rim diameter shows several discontinuities; the distribution of heights probably would be fairly normally unimodal if the sample size were increased. Thus, the overall impression gained from the data is that these ceramics were made by a variety of potters, perhaps part-time specialists, who shaped open bowls to a general pattern without conforming to more rigid standards.

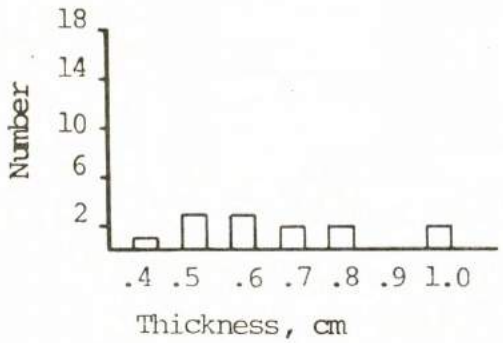
Arambala Vessels (Figure 16)

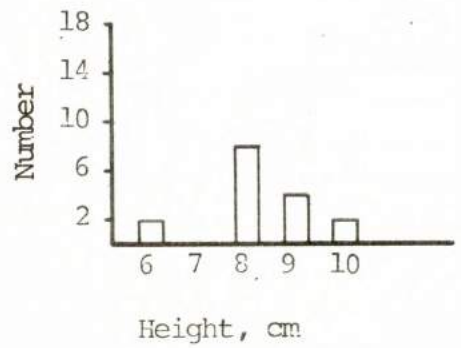
Recurved Bowls. Thickness and height have quite restricted ranges, with well-defined central tendencies (thickness: 5 to 9 mm, modes: 6 and 7 mm; height: 6 to 9cm, mode: 7 cm). The rim diameter distribution is quite discontinuous with three separate clusters, each with a modest mode (14, 18, and 22 cm). The combination of the restricted ranges and the multimodality of rim diameters could signal multiple production units within a standardized system.

Additional observations

Thickness. As observed when discussing individual vessel groups, there generally is a very high consistency in thickness of vessel wall, indicating a good level of technical control -- a by-product of specialization. Chilanga's slightly wider range suggests more variability in technology. Although not directly tabulated, there is other evidence of Copador's and Gualpopa's controlled technology. These cream paste vessels rarely have either carbon cores or firing clouds, thus indicating careful control of the firing process.

Height. The height dimension (on both shapes of bowls, not vases) has a more limited range than does the rim diameter (mean range across types, height: 5.6 cm; mean range, rim diameter: 12.2 cm). It seems likely that vessel height may be restricted by concepts of how the vessel is to be divided for painting and is closely related to decoration standards and motif repertory. It is interesting to note that the modal height for all the bowls is practically identical: open bowls, 8 cm; Copador recurved bowls, 8 cm; Arambala, 7 cm.





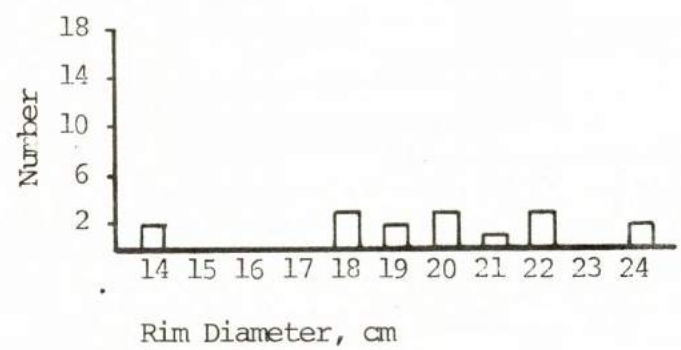
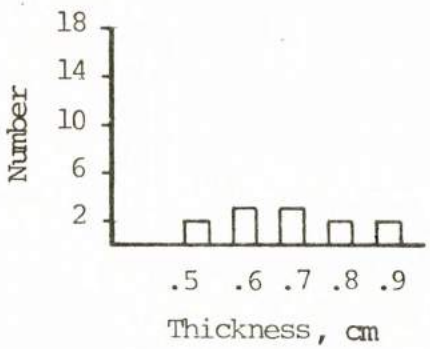
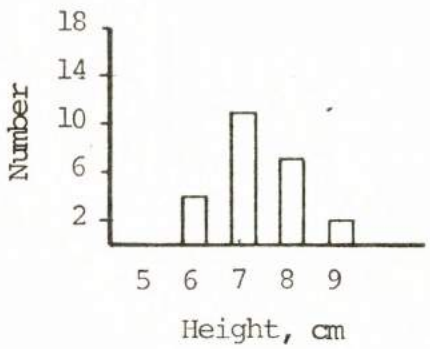


Figure 15: Histogram of Vessel Dimensions, Chilanga Open Bowls





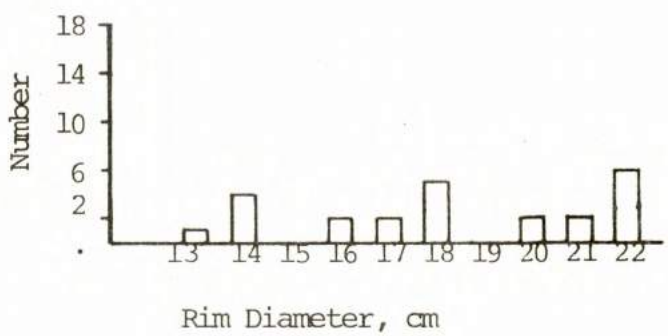


Figure 16: Histogram of Vessel Dimensions, Arambala Recurved Bowls

Rim diameter. This dimension shows the widest range of the three shaping variables analyzed. Also, the shapes of the curves, the degree of central tendency, and the kind of modality are quite disparate. A question arises about the extent to which factors other than the nature and organization of the production units could be influencing this variable. If the ceramics were being made for trade purposes, would transport considerations affect shapes and sizes? Several researchers dealing with Maya area trade have made statements on this subject.

Fry (1980:5), referring to serving vessels, says "....the presence of a range of sizes in the unrestricted orifice subclasses allowing for stacking, suggests that such vessels were potentially very portable." If the goal was to produce stackable vessels, then the distribution pattern of rim diameters would be affected by the number of vessels usually nested, how tightly they were packed, etc.

Rathje et al. (1978:171) illustrated the variation in the potential nesting ability of Classic Period tripod bowls which, with flat bottoms and outcurving rims, were unstable when stacked versus the Postclassic Fine Orange pots which, with round bottoms, incurving rims, and rounded feet, "settled neatly within one another."

Experiments in stacking have not been made on the painted types under investigation; nor is the extent known to which large loads of these types were transported, thereby increasing the importance of compact packability. Nevertheless, considerations of factors like these have to be allowed for in interpreting the data.

FINDINGS: DECISIONS ABOUT MATERIALS NEEDED FOR DECORATING, SLIPS AND PAINTS

Summary

Slip was standardized across the various types. Paints were standardized and simplified on all groups except Copador vases. There appeared to be two subgroups within that category -- one using a simplified palette of black and specular hematite red and the other using an elaborated scheme with tones beyond the standard black, orange, and red.

Detailed Findings

Slips

A soft, variable colored pale orange slip is practically universal across the types and shapes (91 percent) (Table 24). An occasional cream or orange and

cream slip is visible which may represent slight variations in firing conditions. These atypically slipped vessels are too few in number to be analyzed more thoroughly.

TABLE 24

Slip Colors, Vessel Shapes By Type

	Slip Color				
Vessel Shape	Orange	Cream/ White	Orange & Cream	Missing Value	Total
Copador					
Open bowl	44	-	2	-	46
Recurved bowl	56	8	2	1	67
Gualpopa					
Open bowl	39	-	-	-	39
Vase	12	-	-	-	12
Chilanga					
Open bowl	14	1	-	1	16
Arambala					
Recurved bowl	24	-	2	-	26
Total	213 (91.0%)	11 (4.7%)	6 (2.6%)	4 (1.7%)	234 (100.0%)

Paint

Variations among the ceramic groupings are reviewed separately (Table 25).

Copador Vessels

Open bowls. Black and specular hematite red paint are used on all but two of these bowls. Orange paint is somewhat less frequently used -- 16 of the open bowls are decorated without this color. Only two bowls are painted with a nonspecular hematite red paint; two others have an elaborated paint palette of black, specular hematite red, orange, and one other shade such as pink, grey, cream, etc. Thus, there is very little deviation from or elaboration of the basic color scheme of black and specular hematite red.

TABLE 25

Color Combinations And
Shapes By Type

Vessel Shape	Color Combination[a] 1	5	1 + Other	3	6	2	18	14	Total
Copador									
Open bowl	28	14	2	-	2	-	-	-	46
Recurved bowl	27	31	4	1	3	1	-	-	67
Vase	5	13	6	1	3	-	-	-	28
Total	60 (42.6%)	58 (41.1%)	12 (8.5%)	2 (1.4%)	8 (5.7%)	1 (.7%)	-	-	141 (100%)
Gualpopa									
Open bowl	-	3	-	-	31	5	-	-	39
Vase	-	-	-	-	8	3	1	-	12
Total	-	3 (5.9%)	-	-	39 (76.5%)	8 (15.7%)	1 (2.0%)	-	51 (100%)
Chilanga	-	-	-	-	-	-	-	16 (100%)	16[b] (100%)
Arambala									
Recurved bowl	2 (7.7%)	3 (11.5%)	1 (3.9%)	-	15 (57.7%)	5 (19.2%)	-	-	26[b] (100%)

[a]Color combinations:
1) Black, orange, specular hematite red
2) Black, orange, nonspecular hematite red
3) Orange, specular hematite red
5) Black, specular hematite red
6) Black, non-specular hematite red
14) Non-specular hematite red
18) Black & grey
1 + other) Black, orange, specular hematite red and pink or grey

[b]Small sample size should be noted when evaluating percentages (30).

A comment should be made about the specular hematite red paint which is so standard, and distinctive, on Copador vessels. It seems to be a specially selected pigment whose distribution on Mesoamerican ceramics varies over space and time. I have recently argued (Beaudry 1981) that it served as a trade commodity through which interregional contacts can be traced. During the Late Classic period in the southeast Maya zone, its use was restricted to Copador and to a Copan type recently classified as Caterpillar which consists of large, tripodal dishes decorated with glyphic elements allied to those of Copador.

Recurved bowls. Orange paint was not used on half of the recurved bowls. Thus, there appears to be two separate painting formats for this shape -- one with black, orange, and specular hematite and another which eliminated orange, using only black and the specular hematite red. Similar to the open bowl situation, a few recurved bowls (4) used a more elaborate palette and a few (4) employed a nonspecular hematite red.

Vases. The distribution of paint combinations on these vessels suggests two painting approaches -- one of simplification where only black and specular hematite red were used (13) and another where elaboration of color was the goal (14). Six of the vases used additional colors beyond orange, black, and specular hematite red, more than in either of the other two vessel shapes with larger samples.

Gualpopa Vessels

Open bowls and vases. Both of these shapes were painted mainly with just black and nonspecular hematite red paints (39 out of 51). Only a few specimens (8 out of 51) had orange paint added. Three open bowls used specular hematite red instead of the standard nonspecular variety.

Chilanga Vessels

By definition these are a red-on-orange type. All of the red was of the nonspecular variety.

Arambala Vessels

Recurved bowls. As with the Copador group of this shape, orange paint was used on fewer than half the bowls. Five of the 26 bowls used specular hematite as the red pigment. (Assignments to Arambala were based on the paste variation. Stylistically there can be a strong similarity between Arambala and Copador, and when specular hematite paint is used the division relies on the red color and coarser texture of the paste.)

FINDINGS: DECISIONS ABOUT COMPOSITION - SPATIAL DIVISIONS OF EXTERIOR AND INTERIOR DESIGN FIELDS

Introduction

As mentioned in Appendix D when defining a design field, pottery painters envision the surfaces of vessels as being divided spatially and conceive their decoration within these divisions. This manner of organizing the design field would be reflected by the number and width of registers on the interior and exterior walls, by the use of painted bands to delineate these boundaries, etc. These compositional features of the decoration process will be reviewed.

At this point I would like to mention the possibility that different people were responsible for the more technical aspects of the pottery production (shaping and later firing) and for the decoration of the vessel. This suggestion has been made before, by Linne (1965) among others, based largely upon the existence of masterpieces of ceramic painting or modeling. While the types under discussion do not qualify on that basis, a division of labor would be in keeping with the goals of standardized production for an export market.

It should also be mentioned that, with one exception, there was general congruence across the various painted types in terms of the general orientation to the design fields, that is, the surfaces were systematically divided into rim area, wall registers, exterior base or interior bottom. The exception was in a subcategory of Gualpopa open bowls which have been designated "spiral bowls" by previous investigators. This layout uses the entire exterior field, from the lip onto the base which is always convex, as one continuous area for decoration. Motifs are placed on the background slip between a wide red painted band which begins at the lip and spirals around the vessel ending on the base. (See Figure 17.)

Figure 17: Layout of Gualpopa Spiral Bowl

This subcategory will be omitted in the discussion of the exterior design field. It is included in the section on interior design field and is discussed again in terms of its motifs.

Summary

The Gualpopa and Copador vase groupings again showed very limited standardization. The layout of the Copador open bowls (exterior and interior) was more standardized than that of the recurved group. For example, modes on a number of attributes were more pronounced for Copador open bowls than for the recurved groups: exterior rim band width, mode of 0.9 cm or less - open bowls 82.6 percent, recurved bowls 74.6 percent; number of bands between exterior rim and first register, mode of none - open bowls 84.8 percent, recurved bowls 59.7 percent; number of bands between first and second register exterior, mode of 2 - open bowls 62.2 percent, no clear-cut mode for recurved bowls.

Gualpopa (nonspiral) open bowls and Arambala recurved bowls both displayed medium standardization in the approach to their exterior design (modes between 50 and 75 percent except for the number of registers where 92.3 percent of the Arambala vessels had two registers). The interior of the Arambala bowls also are relatively standardized (mode 50 to 53%). Gualpopa interiors vary between painted decorated and unpainted slipped walls; thus standardization is not clear-cut.

There were only limited bases upon which to evaluate standardization of Chilanga open bowls. The exterior showed a moderate amount of standardization although the sample was split between single register and double-register vessels. Interior rim band width was strongly modal (75 percent, 1.0 to 1.9 cm) and all the interior walls and bottoms were undecorated.

Detailed Findings

Exterior design field

Rim. A red rim band is used practically universally on all the ceramic groupings being studied (86.3 percent). Black or black over red very infrequently is substituted (6.4 percent) (Table 26).

The width of the rim band shows some variation among vessel groups but is relatively standardized within each group (Table 26). The standardization of width by shape probably correlates with the earlier observation about the narrow range of measurements on the height dimension. Both of these factors would be involved in the generalized conception of the decorated finished product.

TABLE 26

Color And Width Of Exterior Rim Bands

Vessel Category	Color				
	Red	Black	Black Over Red	None Used/ Data Missing	Total
Copador					
Open bowls	42	1	1	2	46
Recurved bowls	62	2	2	1	67
Vases	22	4	1	1	28
Gualpopa					
Nonspiral open bowls	27[b]	1	-	-	28[a]
Vases	11	-	1[c]	-	12[a]
Chilanga					
Nonspiral open bowls	14	-	-	-	14[a]
Arambala					
Recurved bowls	24	2	-	-	26[a]
Total	202 (91.4%)	10 (4.5%)	5 (2.2%)	4 (1.8%)	221 (100%)

TABLE 26 (Continued)

Vessel Category	Width, cm: 0.9 and less N	%	1.0-1.9 N	%	2.0 and wider N	%	None Used/ Data Missing N	%	Total
Copador									
Open bowls	38	82.6	6	13.0	-	-	2	4.3	46
Recurved bowls	50	74.6	14	20.9	2	3.0	1	1.5	67
Vases	10	35.7	15	53.6	2	7.1	1	3.6	28
Gualpopa									
Nonspiral open bowls	20[b]	71.4	7	25.0	1	3.6	-	-	28[a]
Vases	-	-	6	50.0	5	41.6	1	8.3	12[a]
Chilanga									
Open bowls	2	14.3	12	85.7	-	-	-	-	14[a]
Arambala									
Recurved bowls	18	69.2	7	26.9	-	-	1	3.8	26[a]

[a]Small sample size should be noted when evaluating percentages.
[b]Includes one spiral bowl with a narrow upper register.
[c]Lip only.

Remainder of exterior design field. Table 27 presents the distribution of the number of registers used on the various types of ceramics by shapes.

TABLE 27

Number Of Exterior Registers

Vessel Category	1	2	3	4	7	Total
Copador						(N)
Open bowls	17.4%	80.4%	2.1%	-	-	46
Recurved bowls	-	85.1	11.9	3.0	-	67
Vases	17.9	50.0	28.6	-	3.6	28[a]
Gualpopa						
Nonspiral open bowls	33.3	66.7	-	-	-	27[a]*
Vases	-	25.0	58.3	16.7	-	12[a]
Chilanga						
Open bowls	57.1	42.9	-	-	-	14[a]**
Arambala						
Recurved bowls	-	92.3	7.7	-	-	26[a]

[a]Small sample size should be noted when evaluating percentages.
*11 spiral bowls not divided into registers are omitted.
**2 spiral bowls not divided into registers are omitted.

Tabulations were also made of the number and color of the painted bands used between the rim and the first register as well as between other registers, if they were present. Since the majority of vessels over all the classifications had two exterior registers, data are presented only for bands between the rim and the first registers (all vessels) and between the first and second exterior register for double-register vessels (Tables 28 and 29).

In general, spatial divisions were relatively consistent for bowls but variable for vases. The manner of delineating the divisions - the number of bands and the color(s) used -- was more standard for the Copador open bowls than for the other bowl groupings. The data are briefly summarized in Table 30.

TABLE 28

Number And Color Of Painted Bands Between
The Rim And The First Exterior Register, All Vessels

Vessel Category	Number Of Bands: 0	1			2				3	Total
		Red	Black	Total	Red	Black	Red/Black	Total		
Copador										
Open bowls	39 (84.8%)	3 (6.5%)	4 (8.7%)	7 (15.2%)	-	-	-	-	-	46
Recurved bowls	40 (59.7%)	19 (28.4%)	3 (4.5%)	22 (32.4%)	-	1 (1.5%)	4 (6.0%)	5 (7.5%)	-	67
Vases	17 (25.4%)	8 (11.9%)	3 (4.5%)	11 (16.4%)	-	-	-	-	-	28[a]
Gualpopa										
Non-spiral open bowls	6 (22.2%)	3 (11.1%)	17 (63.0%)	20 (74.1%)	-	-	-	-	1* (3.7%)	27[a]
Vases	1 (8.3%)	-	5 (41.7%)	5 (41.7%)	1 (8.3%)	4 (33.3%)	1 (8.3%)	6 (50.0%)		12[a]
Chilanga										
Non-spiral open bowls	10 (71.4%)	1 (7.1%)	-	1 (7.1%)	3 (21.4%)	-	-	3 (21.4%)	-	14[a]
Arambala										
Recurved bowls	13 (50.0%)	2 (7.7%)	11 (42.3%)	13 (50.0%)	-	-	-	-	-	26[a]

*Black, red, black

[a]Small sample size should be noted when evaluating percentages.
Because of small sample size, both frequencies and percentages are given.

TABLE 29

Number And Color Of Painted Bands Between
The First And Second Exterior Register, Two-Register Vessels

Vessel Category	Number Of Bands: 0	1			2					3	4	Total
		Red	Black	Total	Red	Black	Red/ Black	Black/ Red	Total			
Copador												
Open bowls	0	9 (24.3%)	–	9 (24.3%)	18 (48.7%)	–	5 (13.5%)	–	23 (62.2%)	4 (10.8%)	1 (2.7%)	37
Recurved bowls	20 (35.1%)	8 (14.0%)	5 (8.8%)	13 (22.8%)	16 (28.1%)	2 (3.5%)	1 (1.8%)	4 (7.0%)	23 (40.4%)	1 (1.8%)	–	57
Vases	2 (14.3%)	2 (14.3%)	–	2 (14.3%)	3 (21.4%)	–	2 (14.3%)	3 (21.4%)	8 (57.1%)	2 (14.3%)	–	14[a]
Gualpopa												
Non-spiral open bowls	1 (5.6%)	–	5 (27.8%)	5 (27.8%)	–	–	1 (5.6%)	11 (61.1%)	12 (66.7%)	–	–	18[a]
Vases	–	–	1 (33.3%)	1 (33.3%)	–	–	–	–	–	1 (33.3%)	1 (33.3%)	3[a]
Chilanga												
Open bowls	1 (16.7%)	4 (66.7%)	–	4 (66.7%)	–	–	–	–	–	1 (16.7%)	–	6[a]
Arambala												
Recurved bowls	12 (50.0%)	3 (12.5%)	5 (20.8%)	8 (33.3%)	–	1 (4.2%)	–	3 (12.5%)	4 (16.7%)	–	–	24[a]

*Specific color combinations not given due to small number of cases using this number of bands.

[a]Small sample size should be noted when evaluating percentages.
Because of small sample size, both frequencies and percentages are given.

TABLE 30

Summary Of Data Trends For Composition
Of Exterior Design Field

Vessel Category	Rim Band Width	Rim Band Color	Number of Registers	Bands between rim & first register (all vessels) No.	Bands between rim & first register (all vessels) Color	Bands between first & second registers (only 2-register vessels) No.	Bands between first & second registers (only 2-register vessels) Color	Comments
Copador								
Open bowls	narrow	red	2	0	-	(1)[a]	red	limited variation - most consistent of groupings
Recurved bowls	narrow (medium)[a]	red	2 (3)	0, 1	red	0, 1, 2	mostly red	medium variation, more than open bowls
Vases	narrow, medium	red (black)[a]	varies	0, 1	red	1, 2	red & black	significant variation
Gualpopa								
Open bowls	narrow	red	(1) 2, spiral	1	black	(1) 2	black & red	about same level of variation as Copador recurved
Vases	medium, wide	red	varies	1, 2	black	only three have 2 registers		significant variation

TABLE 30 (continued)

Vessel Category	Rim Band Width	Rim Band Color	Number of Registers	Bands between rim & first register (all vessels) No.	Bands between rim & first register (all vessels) Color	Bands between first & second registers (only 2-register vessels) No.	Bands between first & second registers (only 2-register vessels) Color	Comments
Chilanga								
Open bowls	medium	red	1, 2, (spiral)[a]	0	-	varies, only 6 have 2 registers		medium amount of variation - primarily with regard to basic division of space
Arambala								
Recurved bowls	narrow, medium	red	2	0, 1	black	0, 1	black (red)	medium amount of variation but divisions are almost even suggesting 2 standards rather than deviations from one

[a]Parentheses indicate moderate occurrence of this trend; no parentheses indicates a strong, modal occurrence.

Interior design field.

The same aspects of the spatial division of the vessels were tabulated for the interior design field -- the width and color of the rim band, the width and color(s) of band(s) between the rim and the wall register as well as between the wall register and the interior bottom. Only six vessels, all bowls, had the interior wall divided into more than one register (one Copador open bowl, one Copador recurved, two Arambala recurved, two Gualpopa open). Consequently, data are presented for only the modal layout of a single interior wall register. Tables 31 through 33 contain the tabulations. Table 34 summarizes the tabulated data.

As on the exterior, an interior red rim band is almost universal. Only three groups had a sufficient number of decorated interiors to assess the degree of standardization of the layout. The Copador open bowls were the most standardized, followed by Copador recurved bowls, and then Arambala recurved. It was interesting to note that on Copador bowls of both shapes the standard pattern on the exterior was red bands while on the interior (particularly below the rim) black was preferred.

EVALUATION OF TECHNICAL COMPETENCE[11]

Summary

The two Copador bowl shapes exhibit a workmanlike level of technical competence, being neither outstanding nor inferior examples of craftsmanship. The modest number of vessels with smearing suggests that in some cases the production process was hurried to the point where polishing was done before the paint was thoroughly dry.

In contrast, Copador vases tend to reflect more care in finishing and a higher level of craftsmanship -- heightening the impression of specialization based more on elaboration and uniqueness of product rather than standardization and simplification.

The technical competence exhibited by the Gualpopa open bowls is somewhat lower than that displayed by the Copador pieces. It would seem that Gualpopa producers, while specialized, were not as skillful or were working on a less valuable product which did not warrant the same level of care in its finishing.

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[11]Gualpopa vases are excluded from this analysis since only nine cases could be evaluated. Chilanga open bowls are excluded because their status as a product of specialization is equivocal.

TABLE 31

Color And Width Of Interior Rim Bands

Vessel Category	Interior Rim Band, Color				
	Red	Black	Black Over Red	None Used/ Data Missing	Total
Copador					
Open bowls	46	-	-	-	46
Recurved bowls	63	2	-	2	67
Vases	23	5	-	-	28[a]
Gualpopa					
Open bowls	37	-	-	2	39
Vases	10	1	1	-	12[a]
Chilanga					
Open bowls	16	-	-	-	16[a]
Arambala					
Recurved bowls	23	-	-	3	26[a]
Total	218 (93.2%)	8 (3.4%)	1 (.4%)	7 (3.0%)	234

TABLE 31 (Continued)

Vessel Category	Interior Rim Bands, Width: 0.9 and less N	%	1.0-1.9 N	%	2.0 and wider N	%	None Used/ Data Missing N	%	Total
Copador									
Open bowls	12	26.1	34	73.9	-	-	-	-	46
Recurved bowls	9	13.4	50	74.6	8	11.9	-	-	67
Vases	3	10.7	19	67.9	6	21.4	-	-	28[a]
Gualpopa									
Open bowls	6	15.4	23	59.0	3	7.7	7	17.9	39
Vases	-	-	8	66.7	2	16.7	2	16.7	12[a]
Chilanga									
Open bowls	3	18.8	12	75.0	-	-	1	6.3	16[a]
Arambala									
Recurved bowls	3	11.5	13	50.0	5	19.2	5	19.2	26[a]

[a]Small sample size should be noted when evaluating percentages.

TABLE 32

Number And Color Of Bands Between Rim And Interior Wall Register

Vessel Category	Number Of Bands: 0	1			2				3[f]	4[f]	5[f]	Total
		Red	Black	Total	Red	Black	Black/ Red	Total				
Copador												
Open bowls	7[a] (15.2%)	-	4 (8.7%)	4 (8.7%)	-	33 (71.7%)	1 (2.2%)	34 (73.9%)	1 (2.2%)	-	-	46
Recurved bowls	26[b] (38.8%)	1 (1.5%)	4 (6.0%)	5 (7.5%)	-	29 (43.3%)	1 (1.5%)	30 (44.8%)	4 (6.0%)	1 (1.5%)	1 (1.5%)	67
Vases	27 (96.4%)	-	1 (3.6%)	1 (3.6%)	-	-	-	-	-	-	-	28
Gualpopa												
Open bowls	33[c] (84.6%)	-	6 (15.4%)	6 (15.4%)	-	-	-	-	-	-	-	39
Vases	12 (100%)	-	-	-	-	-	-	-	-	-	-	12
Chilanga												
Open bowls	16[d] (100%)	-	-	-	-	-	-	-	-	-	-	16
Arambala												
Recurved bowls	7[e] (26.9%)	1 (3.8%)	-	1 (3.8%)	1 (3.8%)	12 (46.2%)	-	13 (50.0%)	4 (15.4%)	1 (3.8%)	-	26[g]

[a] 6 plain; 1 decorated wall.
[b] 25 plain; 1 decorated wall.
[c] 32 plain; 1 decorated wall.
[d] All plain.
[e] 6 plain; 1 decorated wall.
[f] Specific color combinations not given due to small number of cases using this number of bands.
[g] One vessel unrecorded on this variable.

TABLE 33

Number And Color Of Bands Between The Wall Register And The Interior Bottom, Decorated Wall Vessels

Vessel Category	Number Of Bands										
	0	1			2					3[a]	Total
		Red	Black	Total	Red	Black	Black/ Red	Red/ Black	Total		
Copador											
Open bowls	5 (12.5%)	1 (2.5%)	19 (47.5%)	20 (50.0%)	-	1 (2.5%)	13 (32.5%)	-	14 (35.0%)	1 (2.5%)	40
Recurved bowls	10 (23.8%)	1 (2.4%)	15 (35.7%)	16 (38.1%)	-	-	14 (33.3%)	-	14 (33.3%)	2 (4.8%)	42
Vases	-	-	-	-	-	-	-	-	-	-	-
Gualpopa											
Open bowls	1 (16.7%)	-	2 (33.3%)	2 (33.3%)	1 (16.7%)	-	1 (16.7%)	-	2 (33.3%)	1 (16.7%)	6
Vases	-	-	-	-	-	-	-	-	-	-	-
Chilanga											
Open bowls	-	-	-	-	-	-	-	-	-	-	-
Arambala											
Recurved bowls	6 (30.0%)	-	3 (15.0%)	3 (15.0%)	-	7 (35.0%)	2 (10.0%)	1 (5.0%)	10 (50.0%)	1 (5.0%)	20

[a]Specific color combinations not given due to small number of cases using this number of bands.

TABLE 34

Summary Of Data Trends For Composition Of Interior Design Field

Vessel Category	Rim Band (all vessels) Width (all vessels)	Color	Bands between rim & wall register (vessels with decorated walls) No.	Color	Bands between wall register & interior bottom (vessels with decorated walls) No.	Color	Comments
Copador							
Open bowls	(narrow)[a] medium	red	2	both black	1, 2	1 = black 2 = black, red	limited variation
Recurved bowls	(narrow)[a] medium	red	0, 2	both black	0, 1, 2	1 = black 2 = black, red	medium variation
Vases	(wide)[a] medium (wide)	red (black)	-	-	-	-	-

TABLE 34 (continued)

Vessel Category	Rim Band (all vessels) Width	Color	Bands between rim & wall register (vessels with decorated walls) No.	Color	Bands between wall register & interior bottom (vessels with decorated walls) No.	Color	Comments
Gualpopa[b]							
Open bowls	medium	red	1	black	varies		sample too small in terms of decorated interior register
Vases	medium	red	-	-	-	-	-
Arambala							
Recurved bowls	(narrow)[a] medium (wide)	red	2	both black	(0, 1) 2	black	more variability than Copador recurved
Chilanga	medium	red	-	-	-	-	-
Open bowls	medium	red	-	-	-	-	-

[a]Small sample size should be noted when evaluating percentages.
[b]Only 7 vessels had decorated interior walls.

Arambala shows the lowest level of technical competence among the polychrome types.

Detailed Findings[12]

Luster

The luster characteristic of the ceramics results from polishing the vessel after it has been painted and has dried. The degree of luster remaining after a particular pot has been archaeologically recovered, of course, is affected by its postdepositional history as well as its original state. Thus, the absolute rating is of less importance than the rating of the types relative to one another. It is expected that each type would have been equally likely to be subjected to varying postdepositional conditions. Thus this influence should be present in all the types as a constant "background noise" and not unduly skew the results.

A five-point scale was used to rate this feature. Table 35 presents the data from this evaluation. The various Copador shapes show a similar pattern with around 30 percent of the vessels being classified at the two upper points of the scale. More Copador recurved bowls are classified at the lower points of the scale. It is possible that shape is an intervening variable in this instance. The surfaces of the recurved bowls have more planes than do those of the open bowls or vases whose surfaces are more continuous. Thus, it is possible that the greater difficulty in polishing recurved bowls led potters to settle for a lower luster.

Gualpopa open bowls definitely show a lower degree of polish relative to Copador open bowls. The sample size for Arambala recurved bowls is quite small, so observations must be phrased tentatively. There does seem to be a tendency for a smaller proportion of Arambala to have a high degree of luster than is true among the same shape of Copador (5.9 percent Arambala; 29.7 percent Copador).

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[12]It should be mentioned that to varying degrees the shape types lacked data on these characteristics. For a number of Chalchuapa specimens (particularly Gualpopa and Arambala bowls), it was necessary to use photos to record attributes. Often it was not possible to evaluate the technical competence without actually handling the piece. Consequently, the sizes of the samples are smaller than the total represented in the rest of the analyses.

TABLE 35

Evaluation Of Luster

	Copador			Gualpopa	Arambala
Degree of Luster	Open Bowls	Recurved Bowls	Vases	Open Bowls	Recurved Bowls
	N=46	N=64	N=27[a]	N=29[a]	N=17[a]
Low	10.9%	15.6%	14.8%	34.5%	23.5%
Low-medium	2.2	12.5	3.7	6.9	5.9
Medium	56.5	42.2	48.1	44.8	64.7
Medium-high	19.6	18.8	14.8	10.3	5.9
High	10.9	10.9	18.5	3.4	
Medium-high/high combined	31.5	29.7	33.3	13.7	5.9
Low/low-medium combined	13.1	28.1	18.5	41.4	29.4

[a]Small sample sizes should be noted when evaluating percentages.

Smearing

Copador vases exhibited the lowest frequency of smearing of any groups examined (3.7 percent). This reinforces the conclusion that these vessels were produced with a high degree of attention to detail. Paint was thoroughly dried before polishing was done. No attempt was made to hurry the finishing process.

In comparison with Copador vases, Copador open and recurved bowls both showed a higher tendency toward smearing as did Gualpopa open bowls (Copador: 22.2 percent open bowls; 17.7 percent recurved bowls; Gualpopa: 33.3 percent open bowls). (The difference between the two Copador bowl shapes was not significant as judged by the X^2 statistic; neither was the difference between the combined Copador bowls and the Gualpopa bowls.)

None of the Arambala bowls showed evidence of smearing. Although the small sample size requires a cautionary note, the finding is interesting since the red paste Arambala type is definitely not part of the same production system as the cream paste Copador and Gualpopa types. (See Table 36.)

TABLE 36

Evaluation of Smearing

Vessel Category	Smeared		Not smeared		Total	
	N	%	N	%	N	%
Copador						
Open bowls	10	22.2	35	77.8	45	100.0
Recurved bowls	11	17.7	51	82.3	62	100.0
Gualpopa						
Open bowls	9	33.3	18	66.7	27	100.0
Arambala						
Recurved bowls	-	-	17	100.0	17	100.0

Craftsmanship

An overall assessment, expressed in a numer- ical rating, was made by the investigator of the manner in which the painting had been done -- the evenness of lines, neatness of filling in outlined areas,

carefulness of executing detail, spacing of motifs, etc. An original four point scale from "finely executed" through "very careless" was expanded during the trial recording phase to a seven point scale to allow for finer distinctions. After initial tabulation, the

data were collapsed into a two-way division in order to have more adequately sized cells with which to work. Tables 37 and 38 present these data in both forms.

As with luster and lack of smearing, the Copador vases exhibited the best level of craftsmanship (79.6 percent = better). The two Copador bowl shapes were not as outstanding as the vases (open bowl, 68.2 percent = better; recurved bowl, 65.1 percent = better). However, both Copador bowl groups were more carefully crafted than either the Gualpopa or Arambala types (Gualpopa open bowl, 23.2 percent = better; Arambala recurved bowl, 35.3 percent = better).

TABLE 37

Evaluation Of Craftsmanship

Rating	Copador			Gualpopa	Arambala
	Open Bowls	Recurved Bowls	Vases	Open Bowls	Recurved Bowls
	N=44	N=63	N=27[a]	N=28[a]	N=17[a]
1 (finely executed)	6.8%	4.8%	29.6%	-	-
1/2	15.9	12.7	22.2	-	-
2 (careful, but not outstanding)	34.1	30.2	22.2	14.3%	17.6%
2/3	22.7	34.9	11.1	17.9	35.3
3 (a little sloppy)	13.6	14.3	7.4	39.3	11.8
3/4	2.2	1.6	-	14.3	29.4
4 (very careless)	4.5	1.6	7.4	14.3	5.9

[a]Small sample sizes should be noted when evaluating percentages.

TABLE 38

Evaluation Of Craftsmanship
(Rating Scale Reduced)

Vessel Category	Better[a]		Worse[b]		Total Evaluated
	N	%	N	%	
Copador					
Open bowl	30	68.2	14	31.8	44
Recurved bowl	41	65.1	22	34.9	63
Vases	21.5	79.6	5.5	20.4	27
Gualpopa					
Open bowl	6.5	23.2	21.5	76.8	28
Arambala					
Recurved bowl	6	35.3	11	64.7	17

[a]Ratings of 1, 1/2, 2 and half of those rated 2/3.
[b]Ratings of 3, 3/4, 4, and half of those rated 2/3.

CHAPTER 5

PRODUCTION DECISIONS:CONTENT AND EXECUTION OF THE VESSELS' DECORATION

INTRODUCTION AND OVERVIEW

The results of production decisions made during the processes of shaping and preparing vessels for decoration led to the conclusion that bowls of Arambala, Copador, and Gualpopa types were products of a type of specialized production characterized by standardization and simplification. Chilanga bowls were not as clearly standardized while Gualpopa and Copador vases were definitely not standardized. (See Table 22, Chapter 4) for a summary of the standardization evaluation for the various production decisions prior to vessel decoration.)

The last set of production decisions to be dealt with relates to the content and execution of the vessels' decoration. These final aspects of ceramic production prior to firing pertain to an aesthetic component -- the selection and use of appropriate motif configurations in a prescribed manner. Decisions concerning these decoration related attributes can be used to investigate two aspects of the production process:

1) The extent to which system wide standards were applied, thereby indicating the homogeneity of the aesthetic component and probably the symbolic content of the pottery.

2) The extent to which groups of vessels showed a consistency in the combining of design related attributes, thereby indicating the degree of quality control exerted during the production and suggesting the number of production units in the system.

Decoration related attributes were subjected to several increasingly complex levels of analysis in order to investigate their patterning. Frequency distributions of selected variables for all the types by shapes were examined. This step was largely a screening device to eliminate shape types that could not be considered products of standardized production. Gualpopa vases and Chilanga open bowls were eliminated at that point. Bivariate analysis through contingency tables indicated sufficiently strong patterning for the

remaining shape types, except Copador vases, to warrant a final step of multivariate analysis. These procedures included both variable clustering to examine system-wide decorative standards and case clustering to indicate the probability of physical centralization of production through a restriction in the number of production units.

Before discussing the conclusions drawn from the multivariate analysis of the shape types included at that level of statistical evaluation, some comments are in order about the shape types not included. At various stages of the analysis, different data sets were eliminated as evidence accumulated that they had not been made in a specialized production system geared toward standardization and simplification. The eliminated groups were Copador vases, Gualpopa vases, and Chilanga open bowls.

The vases represent an interesting set of circumstances. They correspond with the bowl shapes of the same stylistic classifications in terms of raw material resource procurement patterns but the production objectives were different for the different shapes. Bowls were made to achieve a standardized effect. The vases, particularly the Copador ones, were made with the goal of elaboration and uniqueness rather than standardization. These characteristics are indicative of different exchange contexts as well as production considerations. The vases would have received different handling in the production system where they would have represented a greater investment in time and artistic ability.

The Chilanga bowls contain more hetereogeneity in vessel dimensions, spatial composition, and motif combinations than the other bowls. This ties in with the chemical compositional data which indicated that many of the vessels had not been made from restricted resources. Chilanga could, thus, represent an incipient type of specialization, not as developed as the system producing the polychrome bowls.

The groups remaining after bivariate analysis were Copador open bowls, Copador recurved bowls, Gualpopa open bowls, and Arambala recurved bowls. The conclusions drawn from the variable clustering are:

1) The content and execution of the Arambala decoration were very formularized, very standardized.

2) The cream paste types (both Copador shapes and Gualpopa open bowls) were not decorated under tightly controlled or extremely homogeneous system-wide standards. Interestingly, the interiors were more standardized than were the exteriors. The

reasons for this interior-exterior variation can only be suggested at this time. (See Chapter 7.)

The conclusions drawn from the case clustering are:

1) Copador -- There is no evidence for a series of production units, each turning out very consistently decorated vessels. Whether there were many production units or a limited number whose workers were given freedom to interpret general requirements cannot be said for certain. The nature of several of the clusters (one for each bowl type) suggests either some large size production units or more precise adherence to certain decorative dictates.

2) Gualpopa -- Standardization of decoration seems highly unlikely since the clusters are based primarily on compositional relationships.

3) Arambala -- One cluster was derived from vessels having the same attributes as one of the Copador recurved clusters. This could indicate production centralization or merely more faithful copying of the Copador mode. Since Arambala is considered derivative of Copador it is difficult to interpret this part of the data.

In summary, then, standardization in the production decisions concerning decoration of the polychrome bowls appears to have reached only a moderate level. In comparison, standardization was more apparent in those aspects of the production process relating to shaping and preparing the ceramics for decoration. It is possible that production efficiencies in the earlier stages of the manufacturing carried greater benefits to the overall system and were easier to effect than decorative standardization. If, as has been assumed, the goal of the ceramic production was to have available for exchange a supply of a recognizable product, that goal was achieved by the Copador decorators adhering to generalized stylistic canons and motif selection. Rigid decorative standardization would not have been required in the system. Gualpopa decoration is even less standardized than Copador, suggesting that potential consumers accepted diversified decoration on this ware -- perhaps being more concerned with size, shape, or attractiveness of the cream paste body itself.

Several glimpses into considerations of the distribution system emerged from work on the decoration-related production decisions:

1. One cluster of recurved Copador bowls with much variability had primarily Copan Valley proveniences. This suggests that the export product probably was more standardized than that produced for local consumption. (It is possible that the decorative variability relates to the small producers who were using different raw material resources, but this cannot be determined at this time.)

2. There was a selection by size among those recurved Copador bowls exported from the valley.

3. One cluster of recurved Copador bowls with effigy figures was concentrated in the Copan Valley. In the last chapter the tendency had been observed for nonstandard shapes of Copador to be more prevalent in the Valley, again suggesting differing local versus export standards.

FREQUENCY DISTRIBUTIONS[13]

Summary

The frequency distribution data suggested varying degrees of standardization in terms of the preferred decoration variable states within the various vessel groupings. For example, glyphs were a very dominant modal motif combination in the first register of Copador open bowls (35/46), while both geometric figures and swimming human figures were preferred in the second register of these bowls (15 geometric designs/13 swimming figures). Bimodality was also found in the motif combinations for the first register of Copador recurved bowls (glyphs 28; seated figures 28; all others 11). As stated previously, these independent tabulations were used primarily to eliminate shape types that did not exhibit enough decoration standardization to warrant further work. Gualpopa vases and Chilanga open bowls were dropped as part of this screening process.

Detailed Findings

Copador Vessels

The frequency distribution of selected decoration variables on Copador vessels is provided in Table 39.

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[13]Frequencies often are shown without percentages because of the small samples. Percentages are unstable and can be misleading under such circumstances.

TABLE 39

Frequency Distribution,
Selected Decoration Variables
Copador Vessels

Variable	Open Bowls	Recurved Bowls	Vases
	N=46	N=67	N=28
Motif combinations, exterior register 1[c]			
Glyphs (A,B,C) + other motif	14	11	-
Glyphs (A,B,C) only	21	17	13
Glyphs, not A,B,C	0	[a]	9
Swimming figures	2	-	-
Seated figures, facing right	-	22	-
Seated figures, facing left	-	4	2
Seated figures, alternating left & right	-	2	-
Standing figures	-	-	2
Serpent	-	3	-
Bird	-	3	-
All others	9	5	2
Motif combinations, exterior register 2			
Geometric design	15	8	-
Swimming figures	13	9	-
Monkey	4	4	-
Human figures	-	-	7[b]
Human figures & glyphs	-	-	5
Glyphs	-	-	4
Effigy	-	5	-
Solid paint	-	19	-
Solid paint with grooving	-	15	8
All others	5	7	4
Only one register	9	-	-
Motif combinations, interior wall register			None
Glyphs	27	12	
Bird	13	30	
Plain	6	25	

TABLE 39 (continued)

Variable	Open Bowls	Recurved Bowls	Vases
	N=46	N=67	N=28
Motif combinations, interior bottom			Not Decorated
Circle & dot	22	8	
Rosette	6	1	
Crossbands	3	-	
Crossbands with dots	2	18	
Dot	2	4	
Interlaced pattern	-	4	
Plain	6	26	
Obliterated/missing value	5	6	
Colors, exterior, lst register			
Black, orange, specular hematite red	4	9	-[d]
Black, specular hematite red	5	31	9
Black + 1 other	2	6	1
Black + 2 or 3 others	2	2	1
Black	8	3	6
Orange, specular hematite red	16	11	4
Specular hematite red	9	5	5
Colors, interior, wall register			Not Decorated
Black, orange, specular hematite red	3	3	
Black, specular hematite red	9	25	
Black + 1 other	1	3	
Black + 2 or 3 others	-	2	
Orange, specular hematite red	20	7	
Red	7	2	
Unpainted	6	25	

TABLE 39 (continued)

Variable	Open Bowls	Recurved Bowls	Vases
	N=46	N=67	N=28
Number of separate motifs exterior, 1st register			
1	20	40	15[d]
2	14	20	11
3	9	6	1
4	3	1	1

[a]Nonstandard glyphs were used 4 times with one of the standard glyphs so they are subsumed in the other code.
[b]Standing figures = 4.
Seated figures = 2.
Both seated and standing = 1.
[c]See Appendix F for illustrations of the motifs mentioned throughout this chapter.
[d]Not used for bivariate or multivariate analysis; presented for completeness.

Open Bowls (N=46)

An almost exclusive use of glyphs as the main motif in the first exterior register is striking (35/46). Probably related to the preference for glyphic motifs is the relatively frequent absence of black paint in the first register; many of the glyphs are only outlined in red or outlined in red and filled with orange (25/46). Two motifs are most often used in the second exterior register -- geometric designs (15) and swimming figures (13). The interior wall motifs are restricted to glyphs (27) or birds (13); the rest of the open vessels are undecorated (6). The dominant color combination is red or red and orange (27/46). The modal motif for the interior bottom is the circle and dot (22); the rest of the decorated vessels carry a variety of infrequently represented motifs.

Recurved Bowls (N=67)

Glyphs (28) and seated figures (28) are dominant in the first register. Black and specular hematite red are most often used as paint colors (31/67); other paint combinations with black account for most of the other cases (20/67). A solid painted second register, with or without grooving, is present on half the vessels (34/67). The interior wall motif most often is a bird (30/67). It should be mentioned that the specific bird design used on Copador recurved bowls is different from that on the open bowls. Figure 18 illustrates

A. Variety used on recurved bowl interior (Motif 020)

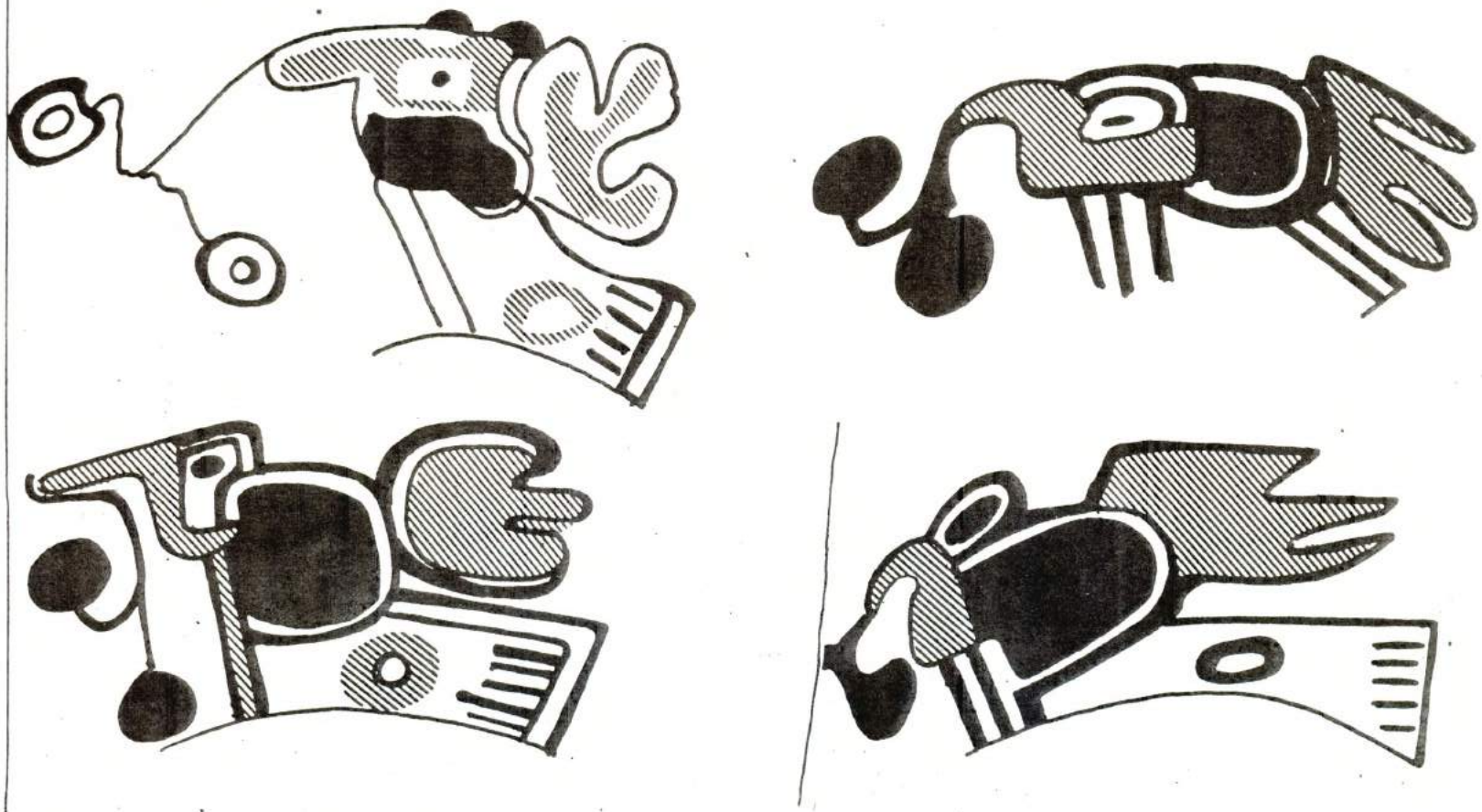

Figure 18: Bird Motifs Used On Interior Walls, Copador Open Bowls and Copador Recurved Bowls

B. Variety used on open bowl interior (Motif 018)

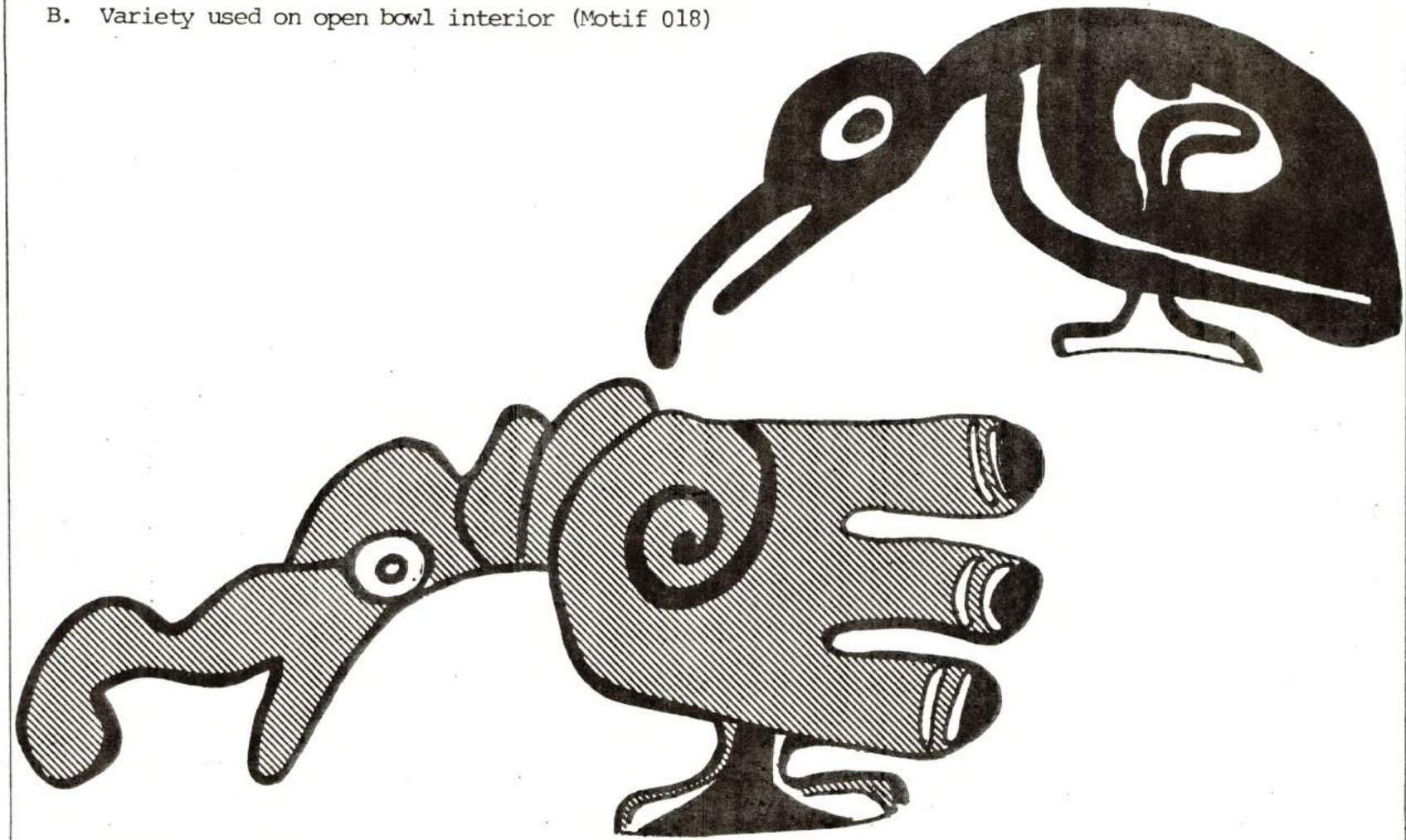

Figure 18 (Continued)

these different executions of the bird motif. A plain interior is found on many recurved bowls (25/67). Paint colors, when used, favor the inclusion of black as on the exterior (33/42 decorated). Interior bowl bottoms, when decorated, most often use the crossbands with dot motif (18/41 decorated).

Vases (N=28)

The first register most often features glyphs (22/28). Paint colors, including black, are favored for the top register (17/28). This contrasts with Copador open bowls where glyphic motifs in the first register tended to be executed in red alone or red and orange. The second register either carries figures, with or without glyphs added (12/28), or, because of the multiregister nature of the spatial division, has solid paint with grooving (8/28).

Gualpopa Vessels

The frequency distributions of selected decoration variables on Gualpopa vessels are provided in Tables 40 and 41.

Nonspiral Open Bowls (N=27)

No clear-cut mode was found for motifs in the first exterior register. The only motif shared by Gualpopa and Copador open bowls in this register was Glyph C. Black alone (10/27) or black and red (14/27) were used in the first register. Base shape was more often convex (17) than flat (10). Most of the interiors were plain (17/27).

Spiral Open Bowls (N=12)

There is a definite concentration of the monkey motif on this spiral open bowls (9/12). Also, the motif called "G fret" is used relatively frequently (5/12). Longyear (1952:58-59) suggests that this motif represents a stylized monkey tail and substitutes for the monkey in terms of symbolic content. The interiors of spiral bowls are not decorated with painted motifs. If they are decorated with other than a slip (4/12), the choice is a negative "batik" effect of wavy lines (Usulutan) (2) or an imitation of the Usulutan effect (2) where the thick slip is scraped and partially removed to create the wavy line design.

Vases (N=12)

Only a few variables were available for tabulation. Neither the choice of motifs nor the colors used in the first register showed much of a pattern of concentration or clear-cut preference. This, in combination with the small sample size, resulted in the decision to remove this group from further analysis.

TABLE 40

Frequency Distribution,
Selected Decoration Variables
Gualpopa Vessels

Variable	Nonspiral Open Bowls	Vases
	N=27	N=12
Motif combinations, exterior register 1		
Complex U shape, alone or in combination	9	4
Glyph C, alone or in combination	6	4
Monkey, alone or in combination	1	4
Bird, alone or in combination	2	-
Other, one motif	6	-
Other, more than one motif	3	-
Color, exterior, 1st register		
Black & red (nonspecular hematite red)	10	2
Black	14	6
Non-specular hematite red	-	4
Other	3	-
Base shape		
Convex	17	0
Flat	10	12
Interior wall treatment		Not Decorated
Plain	17	
Decorated with painted designs of bird	4	
Decorated with painted designs of half moon	1	
Decorated with Usulutan	3	
Obliterated/missing data	1	

TABLE 41

Frequency Distribution,
Selected Decoration Variables
Gualpopa Vessels

Variable	Spiral Open Bowls
	N=12
Motif combinations, exterior (vessel treated as one register)	
Monkey & G-fret	4
Monkey & complex U-shape	1
Monkey & geometric motif(s)	4
G-fret & complex U-shape	1
Complex U-shape & geometric motifs	1
Two geometric motifs	1
Number of motifs on exterior	
2	10
3	2
Base shape	
Convex	12
Flat	0
Interior wall treatment	
Plain	7
Decorated with painted design	0
Usulutan	2
Scraped slip	2
Missing data	1

Arambala Recurved Bowls (N=26)

The predominance of the seated figure in register 1 (15/26) and the solid paint in register 2 (20/26) echo modes of Copador. The dominance of the bird on the interior also aligns with Copador (12/26). (It is the same specific rendering of the bird as on the Copador recurved form, too, not the variety on the Copador open bowl). Interior decoration occurs somewhat more frequently on Arambala (20/26; 76.9 percent) than on this shape of Copador (42/67; 62.7 percent). The frequency distribution of selected decoration variables is given in Table 42.

Chilanga Open Bowls (N=16)

It was very difficult to group the designs used on Chilanga vessels into meaningful motif combinations

TABLE 42

Frequency Distribution,
Selected Decoration Variables
Arambala Vessels

Variable	Recurved Bowls
	N=26
Motif combinations, exterior register 1	
Bird	3
Seated figure facing right	15
Seated figure facing left	4
Other	4
Motif combinations, exterior register 2	
Solid paint	16
Solid paint with grooving	4
Painted design	6
Colors, exterior, lst register	
Black & non-specular hematite red	17
Black, non-specular hematite red, orange	4
Other	5
Motif combinations, interior wall register	
Bird	12
Crosshatch with dots (with or without other motif)	3
All other motifs	5
Plain, slipped only	6
Motif combinations, interior bottom	
Crossband with dots	7
Circle & dot	5
All other motifs	3
Plain	7
Obliterated/missing data	4
Base shape	
Convex	7
Flat	19

since they were quite diverse. Most designs were extremely simple, and many were executed in a most cursive or careless manner. In the first register, simple motifs comprise the majority of the decoration (13/16). Only two vessels contain representational motifs of silhouetted monkeys (one is on a spiral bowl reminiscent of Gualpopa). Simple motifs, frequently continuous zig-zag patterns, were used when there was a second register (8/16). Base shape most often was convex (9/16). The frequency distribution of selected decoration variables is supplied in Table 43.

TABLE 43

Frequency Distribution,
Selected Decoration Variables
Chilanga Vessels

Variable	Open Bowls
	N=16
Motif combinations, exterior register 1	
Discrete linear or solid painted area	4
Continuous linear motif	4
Simple discrete shape	5
More complex geometric shapes	1
Monkey	2
Motif combinations, exterior register 2	
Solid area of paint	1
Continuous linear motif	4
Simple discrete shape	3
One register only	8[a]
Base shape	
Convex	9
Flat	6
Ring base	1

[a]Includes two spiral bowls.

The simplicity of the exterior motifs as well as lack of strong standardization in the shaping dimensions and in the spatial composition, led to the conclusion that Chilanga was most likely not produced in the same kind of production situation as the other types in the study. Before eliminating the data set from further analysis, some additional work was done to see if further insights could be gained from the decorative data. Design motifs were examined across all vessel shapes and without respect for the part of the design field in which the motif occurred. The pots were divided then into those that used design motifs requiring some degree of skill to paint versus those that used the simplest motif which any occasional potter could have managed to produce. (See Table 44 for the classification of design motifs.)

Table 45 shows this tabulation by vessel shape. The findings suggest variation of design complexity by shape, with the complicated designs occurring most often on other than open bowls (16/19) and the simple designs more frequently on open bowls (13/22). Whether these differences are due to shape specialization by potters of different skill levels, functional variability of shapes leading to a higher energy investment in decorating some forms, a status-shape correlation, or other variables unfortunately cannot be determined with the currently available set of data.

Another tabulation was undertaken to determine if there was any correlation between provenience and presence of complicated design. More complicated designs, preferentially distributed by site, could suggest a difference in the production or distribution pattern. Unfortunately, the distribution by provenience is highly skewed in favor of Copan. (See Table 46.) The somewhat larger than expected number of complicated designs in the Rio Hondo collection reflects the shapes from that provenience (two open bowls, three vases, one recurved bowl, and one dish).

Returning to the main thrust of the work, it was decided that little more could be learned about standardization or simplification from the Chilanga ceramic group, so it will not be detailed in the rest of the analysis.

BIVARIATE ANALYSIS

Summary

The contingency table analysis indicated some standardization among motif combinations, motif combinations and paint color usage, and various compositional elements of Copador open bowls. It did not appear to

TABLE 44

Chilanga Motifs Classified As
Simple Or Complex

Simple Motifs	
Catalog No.	Description
038	Dot(s)
042	Panels of color
043	Vertical lines
044	Register of solid color
048	Zigzag line
057	Unattached S
060	U shape
081	Nested chevrons
096	Vertical wavy line
100	Continuous linear pattern
101	I shape
102	Single triangle
105	Straight and squiggle lines
107	Continuous notched band
115	Curvilinear shape
119	Half moon
126	Open ovals with horizontal lines

Complex Motifs	
Catalog No.	Description
029 & 030	Monkey
050	Interlaced design
070	Nested chevrons with curvilinear shape
079 & 080	Hooked line pattern
106 & 139	Geometric figures
108 & 109 & 110	Geometric designs.
114	Bird silhouette

TABLE 45

Shape Of Chilanga Vessels
According To Complexity of Design

Shapes	Design Format		
	Simple	Complicated	Total
Open bowls	13	3	16
Recurved bowls	3	5	8
Vases	1	5	6
Cups	1	3	4
Dishes	1	2	3
Jars	1	1	2
Plates	1	-	1
Markedly incurving bowl	1	-	1
Total	22	19	41

TABLE 46

Provenience Of Chilanga Vessels
According To Complexity Of Design

Provenience	Design Format		
	Simple	Complicated	Total
Copan Valley (both from the center and the outlying settlements)	14	9	23
Western Honduras	1	3	4
Western Guatemala highlands/Guatemala (unknown)	2	1	3
Kaminalyuyu (Central Guatemala highlands)	1	-	1
Rio Hondo (Matagua Valley, Guatemala)	2	5	7
Tazumal (Western El Salvador)	2	1	3
Total	22	19	41

be as strong, however, as standardization of this shape's spatial composition, paint selection, or dimensions. For the recurved bowl shape of Copador, the two-way associations were much stronger.

Copador vases showed few associations that could be related to production circumstances. Most of the relationships seemed more mechanical, related to height-width ratios, etc. Analysis will be terminated at this step for this vessel category.

Gualpopa nonspiral open bowls showed limited two-way associations, reflecting variabiaity in the content and execution of the decoration of these vessels. Arambala vessels showed quite standardized pairs of motif combinations but more variable compositional relationships. This could be interpreted as standardization emanating less from production control than from adherence to design canons.

Detailed Findings

A bivariate analysis was done through contingency tables prepared for various pairs of variables. The program BMDP4F was used to generate the data. Table 47 lists the pairs of variables studied for each shape within each type. Tables 48 through 52 present the contingency tables.

Copador Vessels

Open bowls (N=46)

Contingency tables for Copador open bowls are given in Table 48.

1. Motifs

Exterior: register 1 versus register 2. The motifs in the second register did not distribute differentially according to the motif in register 1. It was noted that the few vessels (9/46) with only one register were aberrant in terms of their motifs: five were in the miscellaneous "all other" category and two used swimming figures which usually are restricted to the lower register of a two-register vessel.

Register 1 exterior versus interior wall register. Several tendencies were noted: 1) If the exterior design is restricted to glyphs, the interior design is likely to be glyphic (14). 2) If the exterior design has both glyphs and another motif, the interior is likely to employ the bird motif (7).

TABLE 47

Contingency Tables Prepared For
Selected Variables By Shape Within Type

Variable	Copador			Gualpopa	Arambala
	Open Bowls	Recurved Bowls	Vases	Non-spiral Open Bowls	Recurved Bowls
	(N=46)	(N=67)	(N=28)	(N=27)	(N=26)
Exterior motifs - Register 1 vs register 2	X	X	X	-	X
Exterior motifs - Wall motif vs bottom motif	X	X	-	-	X
Exterior motif in register 1 vs interior motif on wall	X	X	-	X	X
Motifs - color combination					
1) Exterior register 1 colors vs motifs	X	X	-	X	X
2) Interior wall register colors vs motifs	X	X	-	-	-

TABLE 47 (continued)

Variable	Copador			Gualpopa	Arambala
	Open Bowls	Recurved Bowls	Vases	Non-spiral Open Bowls	Recurved Bowls
	(N=46)	(N=67)	(N=28)	(N=27)	(N=26)
Compositional relationships					
1) Number of bands on interior between rim and wall register vs wall register motif	X	X	-	-	X
2) Number of bands exterior vs motif register 1	-	X	X	X	X
3) Number of motifs on exterior in register 1 vs					
a) motif combinations in register 1	X	X	-	-	-
b) motif combinations in register 2	X	X	-	-	-
4) Number of registers on exterior vs					
a) motif combinations in 1st register	-	-	X	X	-
b) motif combinations in 2nd register	-	-	X	-	-

TABLE 47 (continued)

Variable	Copador			Gualpopa	Arambala
	Open Bowls	Recurved Bowls	Vases	Non-spiral Open Bowls	Recurved Bowls
	(N=46)	(N=67)	(N=28)	(N=27)	(N=26)
Compositional relationships (continued)					
5) Rim diameter vs					
a) motif combinations in 1st register	-	-	X	-	-
b) width of exterior rim band	-	-	X	-	-
c) height of vessel	-	-	X	-	-
d) number of bands between rim and 1st register	-	-	X	-	-
6) Width of exterior rim band vs					
a) width of interior rim band	-	-	X	-	-
b) height of vessel	-	-	X	-	-
7) Base shape vs					
a) interior wall decoration	-	-	-	X	-
b) motif combination, exterior register 1	-	-	-	X	X
c) motif combination, exterior register 2	-	-	-	-	X

TABLE 48

Copador Open Bowls
Contingency Tables

	Motif Register 1, Exterior				
Motif, Register 2, Exterior	ABC Glyphs only	ABC Glyphs +other	Swimming figures	all other motifs	Total
Monkey	2	2	0	0	4
Swimming figure	6	6	0	1	13
Geometric design	8	5	0	2	15
All other motifs	3	1	0	1	5
One reg. only	2	0	2	5	9
Total	21	14	2	9	46

	Motif Register 1, Exterior				
Color, Register 1, Exterior	ABC Glyphs only	ABC Glyphs +other	Swimming figures	All other motifs	Total
Black, orange, specular hematite red	0	0	1	3	4
Orange, specular hematite red	11	4	0	1	16
Black, specular hematite red	1	2	1	1	5
Black, one other color	2	0	0	0	2
Black, two other colors	0	1	0	1	2
Black only	2	5	0	1	8
Specular hematite red only	5	2	0	2	9
Total	21	14	2	9	46

	Motif Register 1, Exterior				
Interior Wall Motif	ABC Glyphs only	ABC Glyphs +other	swimming figures	All other motifs	Total
Plain	4	1	0	1	6
Glyphs	14	6	1	6	27
Bird	3	7	1	2	13
Total	21	14	2	9	46

Table 48 (continued)

Motif Register 1, Exterior					
No. of motifs, Register 1, Exterior	ABC Glyphs only	ABC Glyphs +other	Swimming figures	All other motifs	Total
1	13	0	2	5	20
2	6	6	0	2	14
3	2	6	0	1	9
4	0	2	0	1	3
Total	21	14	2	9	46

Interior bottom motif						
Interior Wall Motif	Circle & dot rosette	Crossbands w or w/o dot	Plain	Dot	Missing data	Total
Plain	0	0	6	0	0	6
Glyphs	17	3	0	2	5	27
Bird	11	2	0	0	0	13
Total	28	5	6	2	5	46

	Interior Wall Motif			
No. of Bands, interior	Plain	Glyphs	Bird	Total
0	6	0	1	7
1	0	2	2	4
2	0	24	10	34
3	0	1	0	1
Total	6	27	13	46

	Interior Wall Motif			
Color, interior wall register	Plain	Glyphs	Bird	Total
Black, orange, specular hematite red	0	0	3	3
orange, specular hematite red	0	19	1	20
black, specular hematite red	0	1	8	9
black + one other non-specular hematite red	0	0	1	1
slipped only	0	7	0	7
Total	6	0	0	6
	6	27	13	46

Motifs, Register 2, Exterior						
No. motifs Reigster 1, Exterior	Monkey	Swimm. figure	Geometric design	All other	One reg only	Total
1	1	3	6	4	6	20
2	1	4	8	0	1	14
3	2	4	1	1	1	9
4	0	2	0	0	1	3
Total	4	13	15	5	9	46

Interior wall versus interior bottom. The bottom motif seems independent of the wall motif.

2. Motif-color correlation

Exterior register 1. When only glyphs are used, there is a strong tendency (16) not to use black; the mode is for red outline and orange fill (11). With the more elaborate designs of glyphs plus other designs and "all other", fewer cases lack black (6).

Interior wall register. Black is used very infrequently when glyphs are the motif (1/27) but, when the bird is the motif, black is almost always used (12/13). This relates to the convention of outlining human and animal figures in black.

3. Other compositional relationships

Number of bands on interior between rim and first register and interior wall motif. The modal number is two. Aberrant cases of one or three bands split between the two categories of motifs (glyphs [3] and birds [3]) If the interior wall is not decorated then no bands are used below the rim band.

Number of motifs in exterior register one (complexity of design) versus

a. Motifs in register 1. This tabulation was not meaningful since the number of motifs is implicitly reflected in the coding of the motif combinations.

b. Motifs in register 2. Swimming figures tended to be associated with more numerous motifs in the first register (10/13). There is a suggestion that the same is true for monkeys in the second register (3/4) but the number of available cases is too small to be reliable.

Recurved Bowls (N=67)

Contingency tables for Copador recurved bowls are given in Table 49.

1. Motifs

Exterior: register 1 versus register 2. There is a strong tendency for seated figures, serpents, and birds to be associated with a solid painted second register (29/34). Glyphs, on the other hand, most often were paired with some

TABLE 49

Copador Recurved Bowls
Contingency Tables

	Motif Register 1, Exterior				
Motif Register 2, Exterior	ABC Glyphs w,w/o other	Seated figure	Serpent/ bird	All other motifs	Total
Solid paint	2	24	5	3	34
Monkey	4	0	0	0	4
Swimming figure	9	0	0	0	9
Effigy	2	1	1	1	5
Geometric design	5	2	0	1	8
Other motifs	6	1	0	0	7
Total	28	28	6	5	67

	Motif Register 1, Exterior				
Color, Register 1 Exterior	ABC Glyphs w,w/o other	Seated figure	Serpent/ bird	All other motifs	Total
Black, orange, specular hematite red	2	7	0	0	9
orange and specular hematite red	11	0	0	0	11
black and specular hematite red	5	20	6	0	31
black + one other	3	1	0	2	6
black + two others	2	0	0	0	2
black only	0	0	0	3	3
specular hematite red only	5	0	0	0	5
Total	28	28	6	5	67

	Motif Register 1, Exterior				
Interior Wall Motif	ABC Glyphs w,w/o other	Seated figure	Serpent/ bird	All other motifs	Total
Plain	18	3	2	2	25
A &/or B Glyphs	8	0	0	0	8
C Glyph	0	1	0	0	1
Bird	2	23	2	3	30
Non-Standard glyphs	0	1	2	0	3
Total	28	28	6	5	67

Table 49 (continued)

	Motif Register 1, Exterior				
No. of Motifs, Register 1, Exterior	ABC Glyphs w,w/o other	Seated figure	Serpent/ bird	All other motifs	Total
1	5	26	4	5	40
2	16	2	2	0	20
3	6	0	0	0	6
4	1	0	0	0	1
Total	28	28	6	5	67

	Motif Register 1, Exterior				
No. of bands, Exterior	ABC Glyphs w,w/o other	Seated figure	Serpent/ bird	All other motifs	Total
0	26	11	1	2	40
1	2	15	2	3	22
2	0	2	3	0	5
Total	28	28	6	5	67

	Interior bottom motif						
Interior Wall Motif	circle & dot/ rosette	cross band, dot	dot	inter-laced pattern	plain	miss-ing	Total
Plain	0	0	0	0	25	0	25
Glyphs	4	2	1	3	1	1	12
Bird	5	16	3	1	0	5	30
Total	9	18	4	4	26	6	67

	Interior Wall Motif			
No. of Bands, Interior	Plain	Glyphs	Bird	Total
0	25	0	1	26
1	0	3	2	5
2	0	7	23	30
3	0	1	3	4
4	0	1	1	2
Total	25	12	30	67

Table 49 (Continued)

Color, Interior Wall Register	Interior Wall Motif			
	Plain	Glyphs	Bird	Total
Black, orange, specular hematite red	0	0	3	3
orange, specular hematite red	0	6	1	7
black, specular hematite red	0	3	22	25
black + one other	0	1	2	3
specular hematite red	0	1	1	2
black + 2 or more other	0	1	1	2
slipped only	25	0	0	25
Total	25	12	30	67

No. Motifs Register 1 Exterior	Motif, Register 2, Exterior						
	Solid Paint	Monkey	Swimming fig.	Effigy	Geometric design	all other motif	Total
1	29	1	1	2	5	2	40
2	5	3	3	2	2	5	20
3	0	0	5	1	0	0	6
4	0	0	0	0	1	0	1
Total	34	4	9	5	8	7	67

painted motif in the second register (26/28). As was observed for the open bowls, however, vessels with glyphs in the upper register were not standardized in terms of second register motifs.

Register 1 exterior versus interior wall register Several tendencies were noted: 1) seated figures in exterior register 1 associate with bird motifs (23/28); 2) glyphic motifs on the exterior most often associate with plain interior wall registers (18/28). However, all Glyphs A and B on the interior wall occur on vessels with exterior glyphic motifs (8). In the two instances where interior glyphs are used with seated figures, one has glyph C and the other has "nonstandard" glyphs. It will be recalled from the frequency distributions that glyphs were used much more frequently on the interior of open bowls than on recurved bowls. However, there does appear to be a recurved subgroup of glyphic interior and exterior decoration allied to the open bowl subset.

Interior wall versus interior bottom. An association was found between the bird interior wall motif and the cross bands with dots bottom motif (16/18). (Since the bird wall motif also associated with the exterior seated figure motif, a multivariate association seems likely.)

2. Motif-color combinations

Exterior register 1. There is a tendency, as in the open bowl category, for black paint not to be used in glyphic motifs (16/28). None of the representational motifs (seated figures, serpents, and birds) lack black paint in their execution. Interentingly, however, orange paint is practically never used with the latter group of motifs.

Interior wall register. The association of glyphs with orange and red and the association of representational motifs (here the bird) with black and other colors is found here, too. In this instance, the bird motif is most often executed in black and specular hematite red without orange paint being used (22/30).

3.Other compositional relationships

Number of bands on exterior between rim and first register and first register motifs. Glyphic motifs most often do not have any painted bands above their register (26/28),

while representational designs most often do. The mode for the seated figure motif group is one band.

Number of bands on interior between rim and first register and interior wall motif. The bird motif most frequently is accompanied by two painted bands (23/30), which was also the mode for open bowls, regardless of motif. The glyph motif vessels all have painted bands but the two-band mode is not as definite (7/12).

Number of motifs on exterior register one versus

a. Motifs in register 1: Not meaningful, see previous discussion.

b. Motifs in register 2: Did not provide any additional insights not available from examining motifs in the second register.

Vases (N=28)

Because of the different shape of the design field and the hetereogeneity of the motif configurations a considerably different set of contingency tables (Table 50) was run. Fewer motif relationships could be examined, more compositional relationships were examined.

1. Motifs

Exterior register 1 versus register 2: No pattern of association could be determined.

2. Compositional relationships

Number of bands on exterior between rim and first register and first register motifs. Relatively little patterning was noted. The exception was in the cases where "standard" A, B, C glyphs had been used in register 1. Most of these vessels (10/13) did not use painted bands below the rim.

Number of registers on exterior versus

a. Motif combinations in register 1. Interestingly, the few cases with figures in the first register were all one register vessels (4). It would seem possible that these pieces are aberrant examples of decoration as were the several open bowls with swimming figures in the single register. No other pattern of association was observed.

TABLE 50

Copador Vases
Contingency Tables

	Motif Register 1, Exterior				
Motif Register 2, Exterior	ABC glyphs only	Human figure	Non-standard glyphs	All other motifs	Total
Human figure only	4	0	0	3	7
Human figures & glyphs	2	0	0	3	5
Glyphs only	2	0	0	2	4
Other motifs	4	0	0	0	4
Solid paint	1	4	2	1	8
Total	13	4	2	9	28

	Motif Register 1, Exterior				
No. of bands, between rim and lst register	ABC glyphs only	Human figure	Non-standard glyphs	All other motifs	Total
0	10	1	1	5	17
Any	3	3	1	4	11
Total	13	4	2	9	28

	Motif Register 1, Exterior				
Number of Registers	ABC glyphs only	Human figure	Non-standard glyphs	All other motifs	Total
1	0	4	1	0	5
2	7	0	1	6	14
3	6	0	0	3	9
Total	13	4	2	9	28

	Motif Register 2, Exterior						
Number of Register	Human Figure Only	Human Figure +Glyph	Glyphs Only	Other Motif	Solid Paint	One Register Only	Total
1	0	0	0	0	0	5	5
2	6	3	2	2	1	0	14
3 or more	1	2	2	2	2	0	9
Total	7	5	4	4	3	5	28

Table 50 (Continued)

No. of bands, between rim and 1st register	Rim Diameter Narrow (8-12 cm)	Medium (13-14 cm)	Wide (15-22 cm)	Total
0	4	7	6	17
Any	4	3	4	11
Total	8	10	10	28

Height	Rim Diameter Narrow (8-12 cm)	Medium (13-14 cm)	Wide (15-22 cm)	Total
Short (12-16 cm)	6	5	1	12
Medium (17-20 cm)	2	5	2	9
Tall (21-24.5 cm)	0	0	7	7
Total	8	10	10	28

Motif, Register 1 Exterior	Rim Diameter Narrow (8-12 cm)	Medium (13-14 cm)	Wide (15-22 cm)	Total
ABC glyphs	3	6	4	13
Human Figures	2	2	0	4
Nonstandard Glyphs	2	2	5	9
All other motifs	1	0	1	2
Total	8	10	10	28

Table 50 (Continued)

	Width, Exterior Rim Band		
Height	Narrow (0-.8 cm)	Wide(1.0-2.2cm)	Total
Short (12-16 cm)	7	5	12
Medium (17-20 cm)	3	6	9
Tall (21-24.5 cm)	1	6	7
Total	11	17	28

	Width, Exterior Rim Band		
Rim Diameter	Narrow (0-.8 cm)	Wide(1.0-2.2cm)	Total
Narrow (8-12 cm)	2	6	8
Medium (13-14 cm)	7	3	10
Wide (15-22 cm)	2	8	10
Total	11	17	28

	Width, Exterior Rim Band		
Width, Interior Rim Band....	Narrow (0-.8 cm)	Wide(1.0-2.2cm)	Total
Narrow (0-.5 cm)	3	1	4
Medium (1.0-1.5cm)	8	4	12
Wide (1.8-3.5 cm)	0	12	12
Total	11	17	28

b. Motif combinations in register 2. No pattern of association was noted.

Rim diameter versus

a. Motif combinations in register 1. A tendency was noticed for figures to be restricted to narrow and medium width vessels. This probably is largely a function of the height-width ratio, however, (figures are on single register vessels), rather than relating to the motif per se.

b. Width of exterior rim band. Very little association was noted.

c. Height of vessel. The expected association of greater height with more width was found. The short vessels were skewed to the narrow and medium height.

d. Number of bands between rim and first register (exterior). There was a slight tendency for medium width vessels to lack painted bands (7/10), but no pattern was observed within the other two rim diameter categories.

Width of exterior rim band versus

a. Width of interior rim band. A wide interior rim band associates with a wide exterior rim band (12/17). A narrow or medium interior rim band is more likely to be associated with a narrow exterior rim band than with a wide one.

b. Height of vessel. A definite pattern is not discernible.

Gualpopa Vessels

Nonspiral Open Bowls (N=27)

Contingency tables for Gualpopa nonspiral open bowls are given in Table 51.

1. Motifs

Exterior register 1 versus interior wall register decoration. Vessels with painted motifs on the interior wall have either Glyph C or a complex U motif on the exterior. It is interesting to note that the one nonspiral bowl with a monkey (the frequently used motif on spiral bowls) carries Usulutan on the interior as do several of the spiral pots.

TABLE 51

Gualpopa Nonspiral Open Bowls
Contingency Tables

Motif, Register 1, Exterior							
Color Register 1 Exterior	Complex U shape	Glyph C	Monkey	Bird	Other, 1 motif	Other, > 1 motif	Total
Black & red	4	0	0	2	2	2	10
Black	3	6	1	0	3	1	14
Other	2	0	0	0	1	0	3
Total	9	6	1	2	6	3	27

Motif, Register 1, Exterior							
Interior Wall Treatment	Complex U shape	Glyph C	Monkey	Bird	Other, 1 motif	Other, > 1 motif	Total
Plain	6	2	0	1	6	2	19
Painted with motif	2	4	0	0	0	0	6
Usulutan	0	0	1	1	0	1	3
Missing/ obliterated	1	0	0	0	0	0	1
Total	9	6	1	2	6	3	27

Motif, Register 1, Exterior							
Number of Bands, Exterior	Complex U shape	Glyph C	Monkey	Bird	Other, 1 motif	Other, > 1 motif	Total
1	7	6	1	1	3	2	20
2	1	0	0	0	0	0	1
None	1	-	0	1	3	1	6
Total	9	6	1	2	6	3	27

Motif, Register 1, Exterior							
Number of Registers, Exterior	Complex U shape	Glyph C	Monkey	Bird	Other, 1 motif	Other, > 1 motif	Total
1	1	4	1	1	1	1	9
2	8	2	0	1	5	2	18
Total	9	6	1	2	6	3	27

Table 51 (Continued)

Motif, Register 1, Exterior							
Base Shape	Complex U shape	Glyph C	Monkey	Bird	Other, 1 motif	Other, > 1 motif	Total
Convex	4	3	1	2	4	3	17
Flat	5	3	0	0	2	0	10
Total	9	6	1	2	6	3	27

	Base Shape		
Interior Wall Treatment	Convex	Flat	Total
Plain	13	4	17
Painted with motif	2	4	6
Usulutan	2	1	3
Missing/obliterated	0	1	1
Total	17	10	27

2. Motif-color combinations

Exterior register 1. The frequency distribution data showed that the paint choice in this register varied between black only or black and red. The preference for black only is attributable in large part to a dominant Gualpopa style of rendering many motifs in silhouette or outline. Thus, all the vessels with Glyph C and the one with a monkey in the first register use black only. Other motifs -- complex U and other miscellaneous motif combinations -- are likely to use either black only or black and red. However, frequently when the two colors are used they are on different elements of the design rather than together as outline and fill as done in Copador.

3. Other compositional relationships

Motif combinations exterior register 1 versus

a. Number of registers on exterior. The mode is for Gualpopa open bowls, like Copador, to have two exterior registers. The subset that uses only one register does not

show any patterning in terms of motifs for that single register. (A majority of the bowls with Glyph C have only one register (4/6), but the number of cases is so small that the association could be spurious.)

b. Base shape. It was hypothesized that the different base shapes could relate to a functional distinction which would also be reflected in motif use. Such a relationship did not manifest itself, however.

c. Number of bands on exterior. No patterning was observed.

d. Interior wall decoration versus base shape. No patterning was observed.

Arambala Vessels

Recurved bowls (N=26)

Contingency tables for Arambala recurved bowls are found in Table 52.

1. Motifs

Exterior register 1 versus register 2. The cases are very limited (N=4) but the atypical left-facing seated figure is always associated with an elaborated second register bearing either painted designs or grooving along with solid paint. The "standard" right-facing seated figure is always associated with a solid painted second register, comparable to the Copador subsample with the same first register motif.

Register 1 exterior versus interior wall register. Several interesting combinations are suggested by this tabulation but can only be stated tentatively because of the small sample size. Again, the left-facing versus right-facing figures seem to represent different decorative schèmes -- none of the left-facing motifs combined with a plain interior and only one (of 4) combined with an interior bird. The right-facing figures most often (11/15) associate with the interior bird. Mention should be made in passing of the interior wall motif of cross-hatching with dots. This design element has been recorded (Beaudry 1980) on a number of pieces from the Middle Motagua region of Guatemala, pieces that share some of the shape and decorative aspects of Arambala but which employ specular hematite paint. It is possible that future controlled excavations in this area of Guatemala will provide stratigraphic evidence

TABLE 52

Arambala Recurved Bowls
Contingency Tables

	Motif Register 1, Exterior				
Number of bands, exterior, between rim & register 1	Bird	Seated figure facing right	Seated figure facing left	Other motif	Total
none	3	8	1	1	13
1	0	7	3	3	13
Total	3	15	4	4	26

	Motif Register 1, Exterior				
Base Shape	Bird	Seated figure facing right	Seated figure facing left	Other motif	Total
Convex	1	4	2	0	7
Flat	2	11	2	4	19
Total	3	15	4	4	26

	Motif Register 1, Exterior				
Motif, Register 2, Exterior	Bird	Seated figure facing right	Seated figure facing left	Other motif	Total
Solid painted	1	13	0	2	16
Painted with design	1	0	3	2	6
Solid painted with grooving	1	2	1	0	4
Total	3	15	4	4	26

	Motif Register 1, Exterior				
Color, Register 1, Exterior	Bird	Seated figure facing right	Seated figure facing left	Other motif	Total
Black and red	2	11	2	2	17
Black, red, orange	0	3	0	1	4
All other combinations	1	1	2	1	5
Total	3	15	4	4	26

Table 52 (Continued)

	Motif Register 1, Exterior				
Interior wall Motif	Bird	Seated figure facing right	Seated figure facing left	Other motif	Total
Bird	0	11	1	0	12
Crosshatch with dots	1	1	1	0	3
All other motifs	1	1	2	1	5
Slipped only	1	2	0	3	6
Total	3	15	4	4	26

	Interior Wall Motif				
Number of bands, interior, between rim & register 1	Bird	Crosshatch with dots	All other motifs	Slipped only	Total
0	0	1	0	6	7
1	0	0	1	0	1
2	9	0	4	0	13
3	3	1	-	0	4
4	-	1	-	-	1
Total	12	3	5	6	26

	Interior Wall Motif				
Interior bottom motif	Bird	Crosshatch with dots	All other motifs	Slipped only	Total
Circle and dot	4	0	1	0	5
Crossbands, dot	5	1	1	0	7
All other motifs	1	1	1	0	3
Plain	0	0	2	5	7
Missing/obliter.	2	1	0	1	4
Total	12	3	5	6	26

	Motif, Register 2 Exterior			
Base Shape	Solid Painted	Painted with motif	Solid with grooving	Total
Convex	5	2	0	7
Flat	11	4	4	19
Total	16	6	4	26

for broadening the Arambala group beyond the motifbased varieties established by Sharer (1978 Vol 3:56-57). (The three pieces in this sample with the crosshatching and dots motif are all from unknown proveniences in Guatemala.)

Interior wall versus interior bottom. The association of the interior wall bird motif and the crossbands with dots bottom motif found in Copador recurved bowls was much less evident here (5/12). The circle and dot bottom motif was as likely to be used with the bird motif (4/12) as was the crossbands with dots. The dutiful replication of the Copador decorative scheme did not seem to apply as forcefully to the bottom of the inside of the vessel, possibly because this is a less visible and therefore less important part of the pot.

2. Motif-color combinations

Exterior register 1. The use of orange paint is quite limited in this set of pots (4/26). The few times it does occur.are most frequently associated with right-facing seated figures in register 1 (3/14). (A corresponding lack of orange paint was noted in the equivalent Copador shape which employed the seated figure motif.)

3. Other compositional relationships

Number of bands on exterior between rim and first register and first register motif. No patterning was evident in contrast with Copador where representational motifs (birds, seated figures) most often used one painted band.

Number of bands on interior between rim and first register and interior wall motif. No patterning was evident.

Base shape versus

a. Motif combination, exterior register 1. There is a suggestion once again of deviation or more variability in the vessels using the left-facing seated figure as their register 1 motif. Half (2/4) of these had the less frequently used convex base.

b. Motif combination, exterior register 2. The only noteworthy aspect is that all the vessels with grooving had flat bases (4)

MULTIVARIATE ANALYSIS

Background

On the basis of the bivariate analysis, it was decided to pursue multivariate analysis on four data sets:

Open bowls	Recurved Bowls
Copador	Copador
Gualpopa	Arambala

These samples would enable examination of decorative variability within type across shape category (Copador) and between types within shape category (open bowls: Copador versus Gualpopa; recurved bowls: Copador versus Arambala) Even though the Gualpopa seemed questionable in terms of level of standardization from the bivariate analysis, it was retained for comparison purposes.

The same variables were used as in the bivariate analysis with the exception of the number of separate motifs in register 1. This variable had shown such high correlation with the motif combination variable that it did not appear useful.

Up to this point in the research, the focus had been on the decorative variables: their distribution across the cases and their co-variation among the cases. Two types of cluster analysis can be performed, however:

1. R-mode analysis, clustering variables

2. Q-mode analysis, clustering cases

These different approaches to isolating structure in data sets have tended to be preferred by various disciplines for different types of classification purposes. Dumond (1974:254) has discussed the two types of analyses as fulfilling varying functions in archaeology:

1. R-mode analysis -- used for extracting "co-varying characteristics from sets of items (for example, attributes from artifacts, types from collection)"; leads to formal definitional categories.

2. Q-mode analysis -- used for "sorting of items (artifacts, collections) on the basis of their characteristics"; leads to grouping of items.

Clarke (1968:534) has pointed out that these two techniques, since they are inverted forms of each

other, "should isolate the same clusters and factors ... within broad limits, albeit approached from different viewpoints." Sneath and Sokal (1973:258) also mention that relationships clearly exist between clusters of cases and clusters of variables.

It was thought that both viewpoints could be utilized for investigating different aspects of the production subsystem:

> -- R-mode analysis can investigate standardization from the viewpoint of formularization of decoration-related decisions -- the consistency of use of the different variable states on vessels of the same shape. The findings can be interpreted in terms of system-wide standards for decoration.
>
> -- Q-mode analysis can investigate standardization from the viewpoint of groups of vessels that share decoration-related variable states. The findings can be interpreted as evidence for production centralization, related to the number of production units.

The variables being used for the multivariate analysis were all multi-state and qualitative (nominal) rather than continuous. Thus, it was necessary to find a computer program that could handle this type of data in preparing the similarity matrix. (Most available statistical packages [BMD, SAS, etc.] are limited to continuous variables.) The NTSYS series from NYSU at Stony Brook, available in UCLA's OAC library, was used in this stage of the analysis.

As a review of statistical literature reveals, cluster analysis is not a unitary approach but rather is a series of numerical procedures that eventually will result in various classifications according to the options chosen. The two essential components are 1) method of estimating similarity or distance (coefficients of association) and 2) rules applied for cluster formation.

Similarity matrices Numerous coefficients of association are described in numerical taxonomy volumes (e.g., Sokal and Sneath 1963:128-141), and NTSYS offers 16 options from which to choose. The simple matching coefficient (S_{SM}) was used because of its applicability to qualitative data and its ability to handle missing values (Doran and Hodson 1975:140).

Cluster formation A number of "options" are available for this part of the work, also (Sneath and Sokal 1973:202-214). NTSYS performs sequential agglomerative hierarchical cluster analysis, giving the user seven alternatives in terms of the specific type of

average linkages that can be used. The unweighted pair-group method using arithmetic averages (UPGMA) was employed since it is the most widely used method (Sneath and Sokal 1973:230-233) and the one that is less likely to lead to possible distortion of the results (Aldenderfer 1977:10).

Variable clustering

Summary

The approach to decorating these painted wares does not seem to represent a strong "formularization" of the entire design scheme. Rather, it appears that a series of independent decisions was made regarding different parts of the vessel. Although the specifics vary, for each group interior variables are the first to cluster.

The motif combinations in the first register on the exterior -- which might be considered the most important or dominant part of the design field -- are quite independent, joining in at a very low level of association on both Copador and Gualpopa bowls.

The Arambala data are interesting because, while they support the idea of a series of decisions about different aspects of the decoration, the association levels are much higher. Motifs in register 1 join other variables much sooner than in the other groups. The Gualpopa variable clusters had a somewhat different set of variables, so direct comparison cannot be made too easily. It has been noted, however, that register 1 motifs were quite independent here as with Copador. Motif combinations from register 2 had been removed from the analysis early in the project because they were so scattered and inconclusive -- another indication of no standardization.

The observation that the motifs in various parts of the design field seemed more related to other variables rather than to each other led me to experiment with running cluster analyses of only the motif combinations. This was done for the two Copador groups and for the Arambala recurved bowls. Figure 19 presents the dendrograms. It is interesting to note that each group shows a different pattern of associations, again reinforcing the idea of varying approaches to the ceramic decoration rather than a widespread application of a set pattern.

Detailed Findings.

Figures 20 through 23 present the dendrograms resulting from the NTSYS variable cluster analysis. For discussion purposes, only associations of 0.400 or higher are reviewed below. This is an arbitrary level

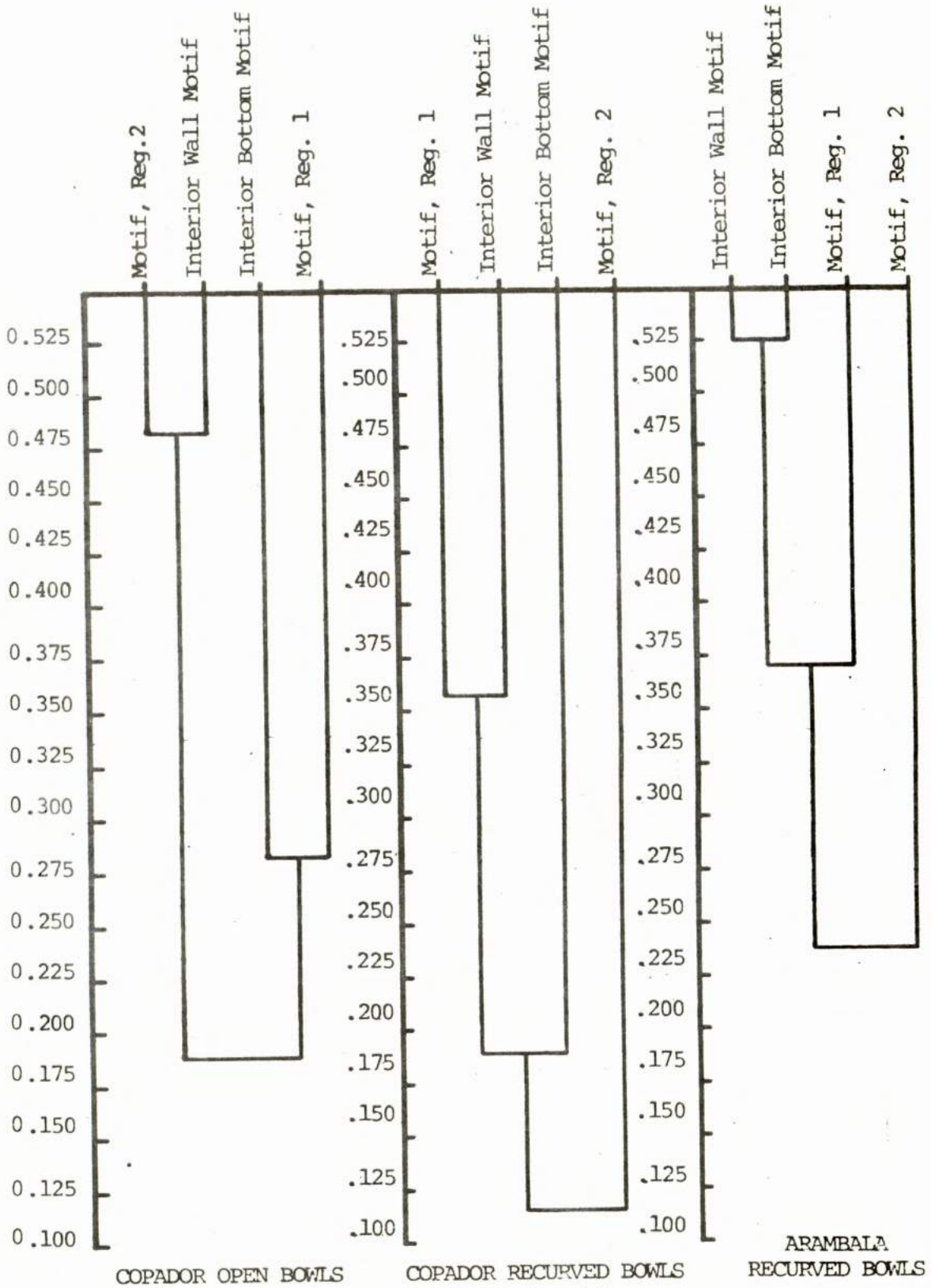

Figure 19: Dendrograms, Cluster Analysis of Variables, Motif Combinations Only

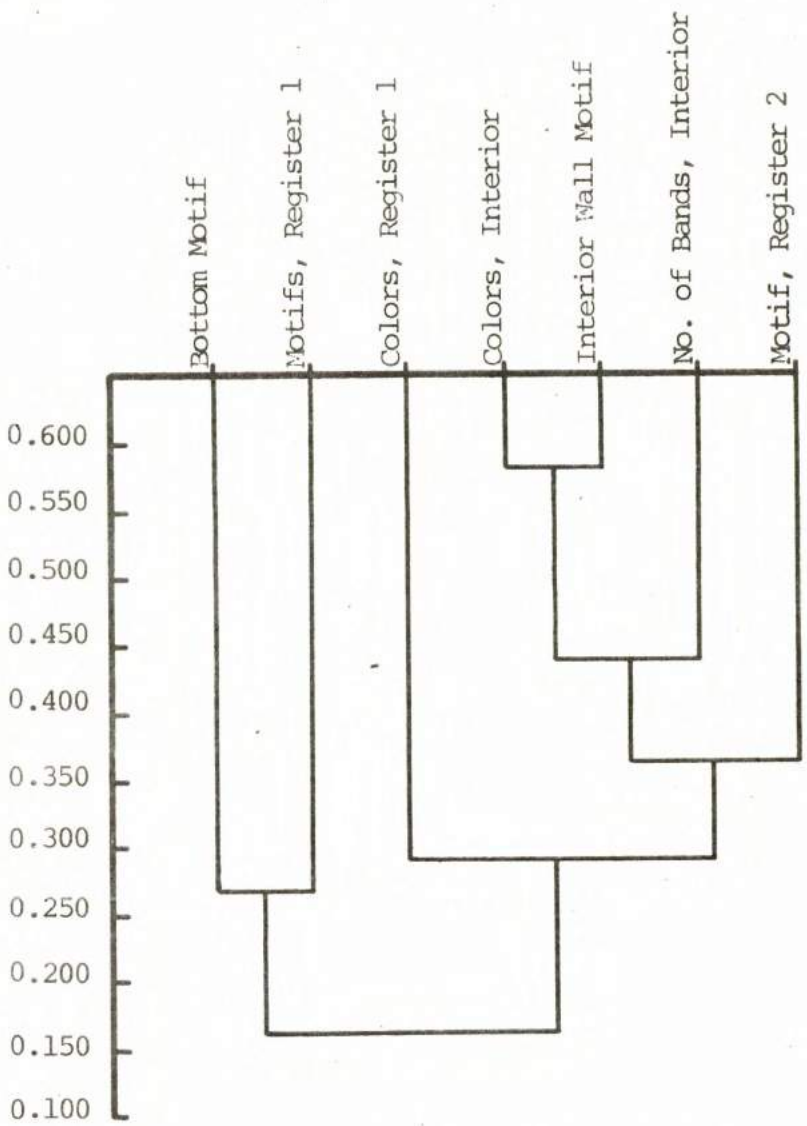

Figure 20: Dendrogram, Cluster Analysis of Decoration-Related Variables, Copador Open Bowls

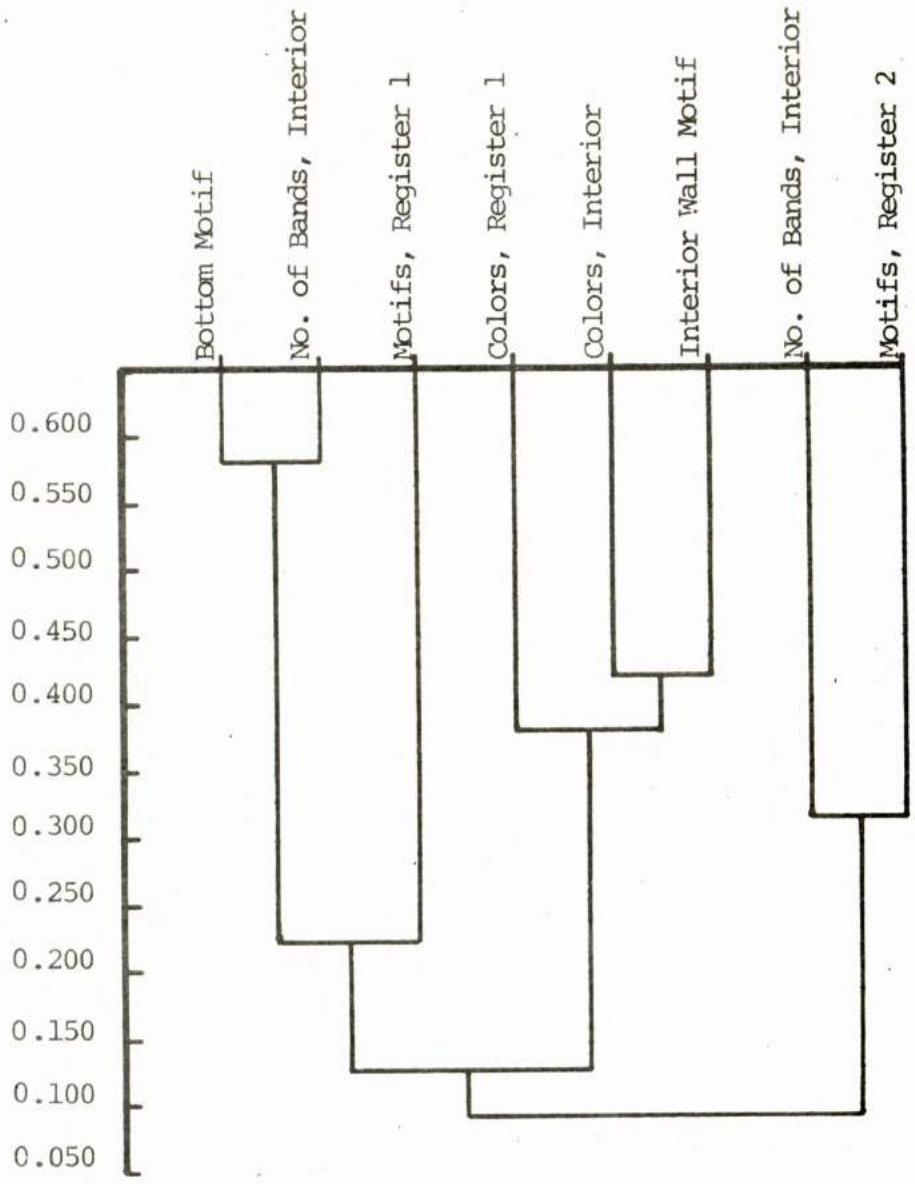

Figure 21: Dendrogram, Cluster Analysis of Decoration-Related Variables Copador Recurved Bowls

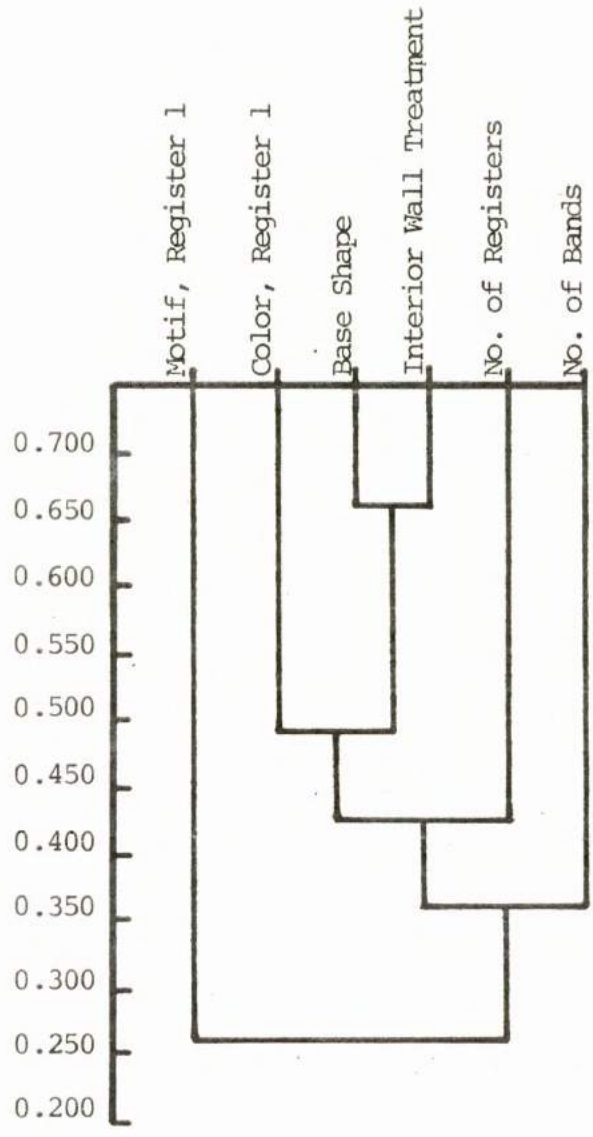

Figure 22: Dendrogram, Cluster Analysis of Decoration-Related Variables, Gualpopa Non-Spiral Open Bowls

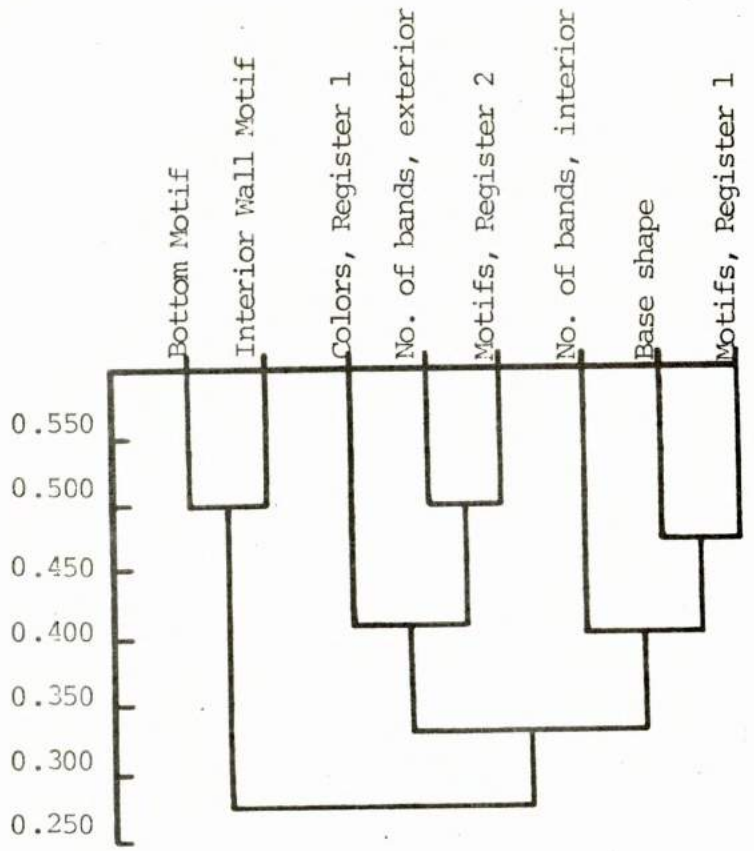

Figure 23: Dendrogram, Cluster Analysis of Decoration-Related Variables, Arambala Recurved Bowls

selected on the basis of what is considered a moderate yet reasonable level of association, as well as one which represents approximately the mid-point of the association levels observed in this set of data.

Copador Open Bowls. The clustering of attributes for this vessel shape did not show many high level associations. One cluster at the 0.4457 level of association grouped three variables of the interior decoration - colors, wall motif, and number of bands below interior rim. The other interior motif variable, the bottom motif combination, did not associate at all with this group and only joined one other variable (motif combinations, register 1 exterior) at a very low level (0.2683).

Copador recurved bowls. Two pairs of associations above the 0.400 level were recorded: 1) number of bands on interior and interior bottom motif, and 2) interior wall motif and interior colors. The motifs in both exterior registers associate with other variables only at low levels.

Gualpopa open bowls. Two pairs of associations emerged above the 0.400 association level: 1) number of bands exterior and number of registers exterior, and 2) interior wall decoration and base shape. Motifs register 1 associated only at 0.289.

Arambala recurved bowls. At the 0.400 level of association, the eight variables were clustered into three associational groups: 1) interior bottom motif and interior wall motif, 2) number of exterior bands, colors on exterior register 1, and motifs on exterior register 2, and 3) number of interior bands, base shape, and motifs on exterior register 1.

Case Clustering

Summary

The case clustering results reinforced the conclusions from the variable clustering that not one overriding set of decorative standards applied to vessels of the same shape within a type. The case clusters showed varying amounts of internal diversity and varying size of membership.

The Copador recurved bowls with the largest number of cases divided into the fewest clusters, with one of the three seeming to group primarily because of the bowls' plain interior. Nevertheless, it is reasonable to conclude that stricter control was exerted or few production units were involved in making this particular Copador shape.

Copador open bowls divided into more clusters, suggesting more production units or more freedom within a large workshop setting.

One of the Arambala clusters coincided with one of the Copador recurved clusters in its salient dimensions. The other two reflect compositional or shaping congruences rather than motif-related similarities.

For Gualpopa clusters other than spiral bowls, motif communality did not seem to be the determining factor. Standardization in other features -- spatial organization, base shape -- were the criteria for clustering.

Detailed Findings

Figures 24 through 27 show the dendrograms resulting from the case cluster analysis. Once the clusters had been derived, descriptive statistics by cluster were run to examine the areas of communality in the groupings. This analysis is discussed by vessel shape within type.

Copador Open Bowls

Cluster 1 (N=24). This group is distinguished by the inclusion of all vessels with swimming figures located in the second exterior register (N=13). Other communalities are a preponderance of glyph only motifs on the interior (N=23) and a majority of glyphs alone on the first exterior register (N=14). Black is infrequently used on the first exterior register (N=7) or the interior wall (N=1). The interior bottom motif most often is the circle and dot combination (N=14). In order to examine in more detail both the communalities and the variability within the cluster, contingency tables were obtained. (See Table 53.)

One question concerned the subgroup with the swimming figures in register 2. Were these, perhaps, representative of one "design school" which followed a standard approach to painting the rest of the vessel? When motifs in register 2 were cross-tabbed with motifs in register 1 in the coded form used for the cluster analysis no pattern could be discerned. The cross-tab was then rerun using the more detailed category codes. The lack of standardization in choice of specific motif for register 1 is still apparent. The absence of Glyph C, as well as glyphs other than "standard" A and B, is notable, however. The interior wall motif on the swimming figure vessels showed a tendency to use only Glyph A (8/13), but other motif combinations were also allowed.

Another question related to possible patterned associations between the use of the standard A, B, C

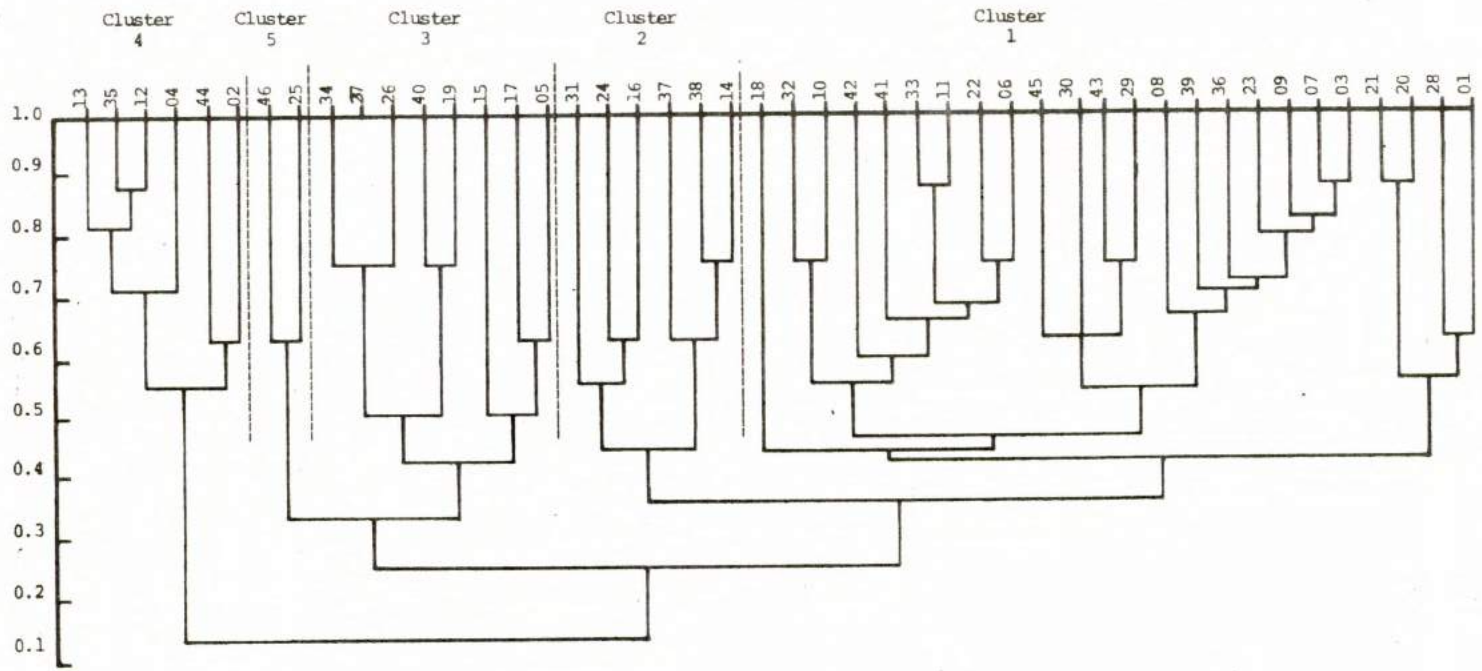

Figure 24: Dendrogram From Cluster Analysis of Cases, Copador Open Bowls

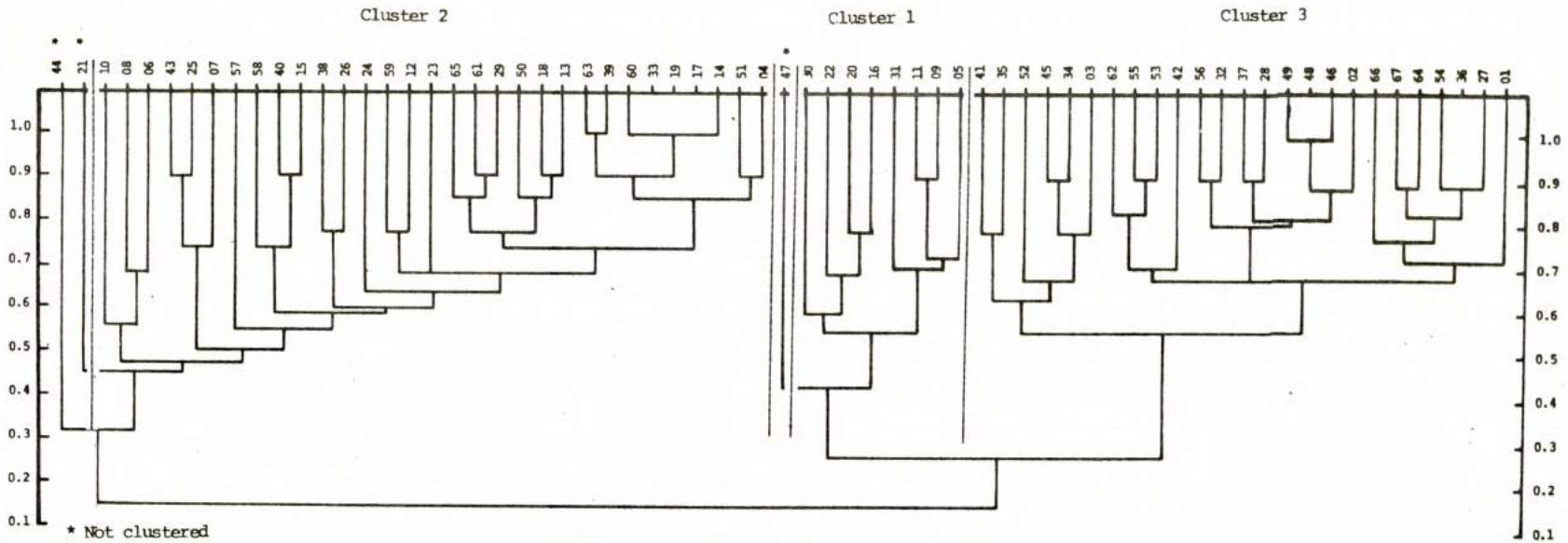

Figure 25: Dendrogram, Cluster Analysis of Cases, Copador Recurved Bowls

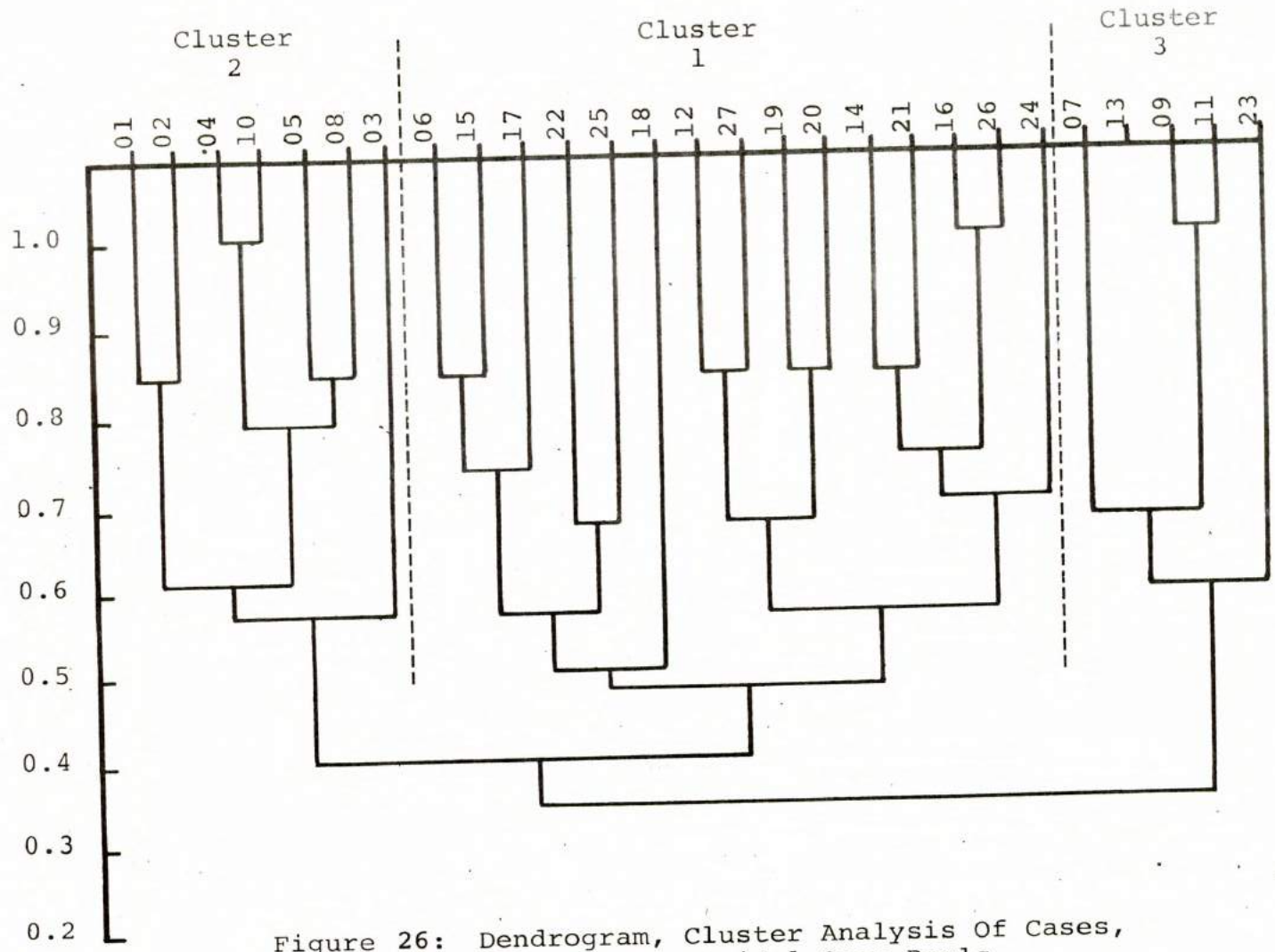

Figure 26: Dendrogram, Cluster Analysis Of Cases, Gualpopa Non-spiral Open Bowls

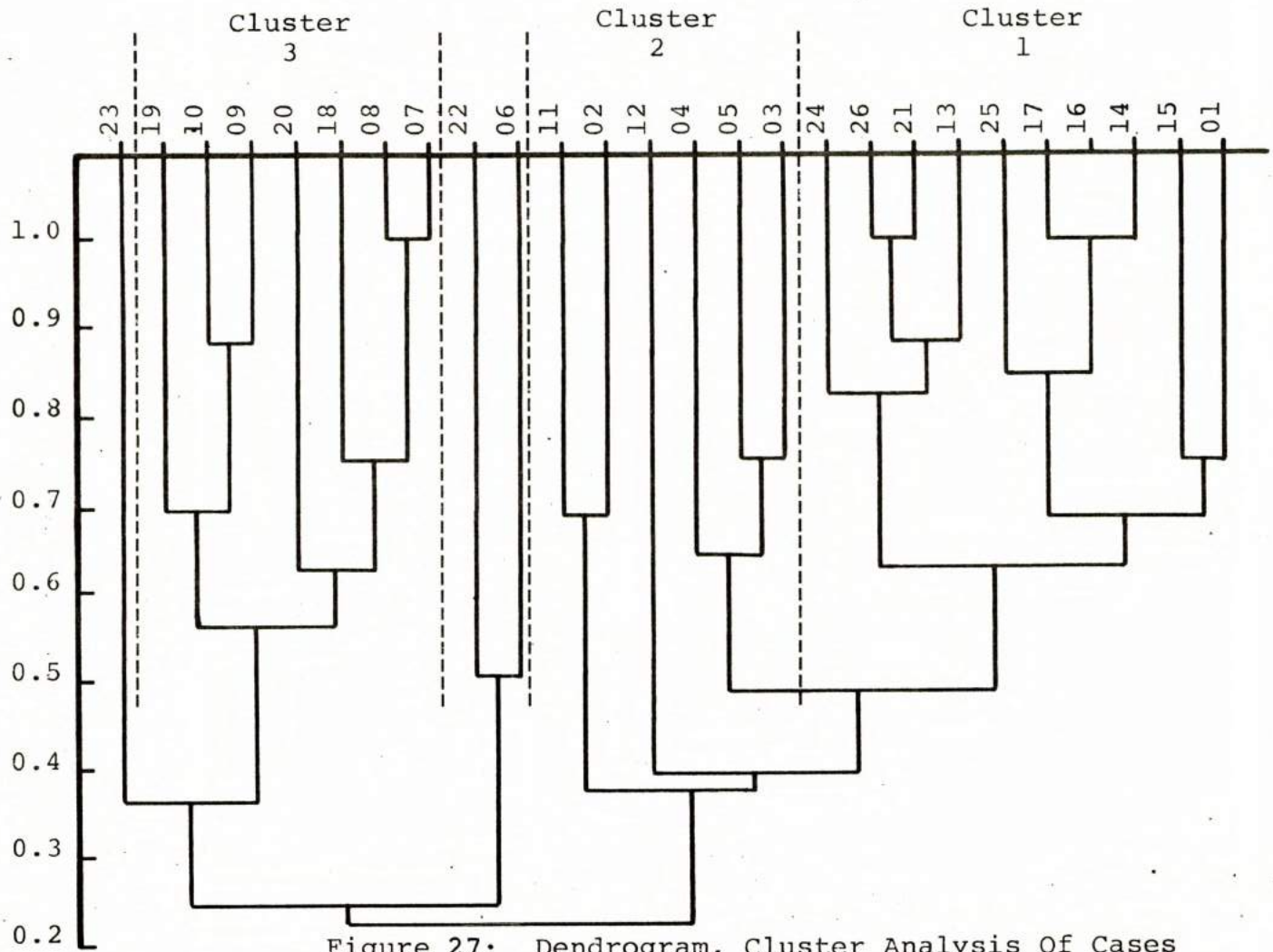

Figure 27: Dendrogram, Cluster Analysis Of Cases Arambala Recurved Bowls

TABLE 53

Cluster 1, Copador Open Bowls
Contingency Tables, Selected Variables

	Motif, Register 1, Exterior (Broad grouping)			
Motif, Register 2, Exterior (Broad grouping)	ABC Glyphs only	ABC Glyphs + other	All other motifs	Total
Swimming figure	6	6	1	13
Geometric design	6	1	2	9
All other motifs	1	0	0	1
One register only	1	0	0	1
Total	14	7	3	24

	Motif, Register 1, Exterior (Detailed grouping)					
Motif, Register 2, Exterior (Detailed grouping)	Glyph A only	A&B Glyph	Geometric design glyph	Shell and glyph	All other motifs	Total
Swimming figure combination	3	3	2	4	1	13
Geometric figure	0	0	0	1	1	2
Geometric design	2	1	0	0	0	3
Rectangles off band, exterior bottom	1	1	0	0	1	3
Linear design	0	1	0	0	0	1
All other motifs	1	0	0	0	0	1
One register only	1	0	0	0	0	1
Total	8	6	2	5	3	24

	Motif, Register 1, Exterior (Detailed grouping)					
Interior Wall Motif (Detailed grouping)	Glyph A only	A&B Glyph	Geometric design glyph	Shell and glyph	All other motifs	Total
Glyph A	6	5	1	3	1	16
Glyph A & B	1	1	0	0	0	2
Glyph C	0	0	0	1	1	2
Bird	0	0	0	1	0	1
Glyph A & B + other	1	0	1	0	0	2
Glyph B	0	0	0	0	1	1
Total	8	6	2	5	3	24

	Motif, Register 2, Exterior (Detailed grouping)							
Interior Wall Motif (Detailed grouping)	Swim. fig.	Combo Geo. Fig.	Geo. Motif	Recti- linear	Linear design	All other motif	One reg only	Total
Glyph A	8	1	3	2	1	0	1	16
Glyph A&B	1	0	0	0	0	1	0	2
Glyph C	1	1	0	0	0	0	0	2
Bird	1	0	0	0	0	0	0	1
A,B,other	2	0	0	0	0	0	0	2
B	0	0	0	1	0	0	0	1
Total	13	2	3	3	1	1	1	24

glyphs on the interior and exterior. Regardless of whether A is used alone on the exterior or in combination with B, the choice for the interior is likely to be Glyph A alone; in fact, Glyph A alone is a strong mode (16/24) for the interior wall motif in the entire cluster. (Only one example of it on the interior walls of open bowls is not in this cluster.)

Cluster 2 (N=6). This grouping represents a small subset of vessels all of which have only one register, atypical for this vessel shape. Interestingly, the height range is equivalent to that of the other clusters, so the choice of using one register did not necessarily relate to space limitations. The exterior designs tend to be aberrant, also. Several vessels use seated figures alternating with glyphs, and one has elaborate banners painted not only in the standard colors but with added tones of pink and brown. Two have swimming figures, but one of these repeats three times, another deviation from the norm.

This cluster, then, really demonstrates the underlying variability within the shape rather than significant standardization.

Cluster 3 (N=8). This cluster is characterized by the use of a bird as the interior wall motif (N=8). All but one vessel have nonrepresentational motifs in register 2 and all have Glyph C in the first register, usually in combination with another element.

Cluster 4 (N=6). Lack of interior decoration sets this cluster apart. Exterior motifs vary considerably. It was noted, however, that three of the four monkey motifs were in this cluster, indicating correlation between this motif and the undecorated interior. (Monkeys are a more frequent motif on Gualpopa open bowls which usually have an undecorated interior, also.)

Cluster 5 (N=2). These two bowls have a "melon stripe" treatment of the second exterior register, a bird on the interior wall, and a rosette on the interior bottom. One carries a G-fret motif in the first exterior register while the other uses nonstandard glyphs.

Copador Recurved Bowls

Cluster 1 (N=8). These bowls all carry glyphic motifs (A or A and B) in the upper exterior register and on the interior wall. They also share compositional features of separating the two exterior register with two painted bands but not using any bands between the rim and the first exterior register. The exterior rim band is also very consistent in depth, ranging only from 8 to 10 mm. On the interior two bands are used between the rim and the wall register. The mode (N=5)

also uses two bands between the wall register and the interior bottom. Motifs on the bottom are varied as are motifs in the second exterior register.

Cluster 2 (N=31). A strong association occurs in this group with seated figures in the upper register, a solid painted lower exterior register, and birds as the interior wall motif (N=22). Only three of the seated figure vessels show the figure facing left while one has alternating left and right-facing figures. On all the rest the figure faces right. Figures of serpents or birds occasionally replace the seated figure in the top register; an infrequent use of continuous linear patterns in the upper register also was found. This cluster contains a high representation of special shaping -- basal angles, diagonal or vertical grooving, and faceted flanges. Orange paint was infrequently used either on the interior or the exterior with black and specular hematite red being the norm. Although most of the bowls have the standard treatment of red interior and exterior rim bands, a few (N=4) have variations of zones of different colors, etc., in the rim area.

Cluster 3 (N=25). There is quite a bit of variability within this group which is associated primarily because of its plain interior. Glyphic motifs predominate in the first exterior register but vary among the specific glyphs. All the vessels with frog effigies in the second register are in this cluster as are six of the nine vessels that have swimming figures in the second register. This cluster is more variable than the other two for this shape category.

Cases not clustered: 3

Gualpopa Open Bowls

Cluster 1 (N=15). This cluster appears to be fairly loosely defined on the basis of having mostly multiple exterior registers, plain interiors, and convex bases. The motif combinations in register 1 on half of the vessels are from the complex-U shape category; the rest of the motifs are quite hetereogeneous.

Cluster 2 (N=7). This grouping is made up of vessels which have either a complex U shape (N=5) or a single geometric motif in register 1. All the vessels have two registers and a flat base. All but one have one red-painted band between the rim and the first register.

Cluster 3 (N=5). First register motifs divide between Glyph C and the monkey. The cluster shares the characteristics of having only one register, using

black only in that register, and placing one painted band between the rim and the register. The interior wall and the base are variable.

In addition to these three clusters of nonspiral bowls, Gualpopa contains a well-defined cluster of spiral bowls. As discussed in an earlier section, this subgroup is quite homogeneous in terms of its motifs, base shape, and interior wall treatment.

Arambala recurved bowls

Cluster 1 (N=10). All these bowls have the seated figure motif in exterior register 1 (all facing right) and a solid painted second register. Except for one case the interior motif is the bird. Black and red without orange is the paint combination for the exterior. The base shape varies between convex (N=4) and flat (N=6). The most frequently used interior bottom motif is crossbands with dots (N=5), but this variable is not as modal as some of the others.

Cluster 2 (N=6). This cluster is not quite as homogeneous as cluster 1. Its strongest communalities are a flat base (none are convex as in cluster 1) and the use of grooving on the solid painted exterior register below the angle. Motifs in the first exterior register vary between seated figures and birds; interior wall motifs are most often, but not exclusively, birds.

Cluster 3 (N=7). This set of vessels shows more standardization in terms of compositional considerations than motif combinations. For example, all the bowls use only black and red paint in the first register, do not have any painted bands under the exterior rim, and rest on flat bases. Motifs in register 1 divide between seated figures (N=5; 2=left-facing, 3= right facing) and Glyph C. The second register decoration varies. Four vessels have undecorated interiors; the other three vary in terms of the painted motifs used.

Cases not clustered: 3

Additional Analyses

Comparison of Copador case clustering results with the motif-based varieties established by Sharer

As a part of the Chalchuapa ceramic analysis, Sharer (1978a Vol 3:53-55) had divided Copador vessels into motif-based varieties. During the recording of the vessels being used in this work, each pot was assigned to one of the Sharer varieties. Using his stated criteria for establishing the varieties, a number of the vessels had to be considered variations or

TABLE 54

Frequency Distribution, Copador Vessels
According To Sharer's Motif-Based Varieties

Sharer Variety	Distinguishing Characteristics	Open Bowls	Recurved Bowls	Total	Sharer Rank Order
Glyphic A	Glyphs (without swimming figure)	8	4	12	1
Glyphic B	Glyphs (with swimming figure)	13	3	16	4
Glyphic C	Seated figures or serpents[a]	-	5	5	3
Glyphic D	Vase forms	-	-	-	5
Glyphic E	Monkey in register 2	-	1	1	7
Figure A	Geometric exterior and bird on interior	4	3	7	6
Figure B	Seated figure[a]	-	23	23	2
Variations on Glyphic A		4	4	8	
Variations on Glyphic B		1	6	7	
Variations on Glyphic C		5	1	6	
Variations on Glyphic E		-	4	4	
Variations on Figure A		4	-	4	
Variations on Figure B		-	1	1	
Could not classify		7	12	19	
Total		46	67	113	

[a]Sharer's descriptions are very similar for these two varieties.

could not be classified. (See Table 54.) Once the case clustering had been completed, the resulting groupings were analyzed to see how they distributed among the Sharer varieties. If the two approaches were measuring the same underlying structure in the material, then a high level of correspondence would be expected in terms of cases being assigned to a Sharer variety and to a cluster grouping. Tables 55 and 56 show the results for this comparison and Table 57 summarizes these findings.

General correspondence can be found between the two approaches to classifying the vessels. Sharer's scheme seems to give most weight to one, or occasionally two, distinguishing motifs, with the other designs treated in a modal manner. The clustering procedures, on the other hand, consider all the variables equally in assigning cases to clusters. These differences in procedures can lead to different case assignments. Also, Sharer does not mention plain interiors or single register variants of the open bowls. These features account for several clusters that did not fit well into his scheme. (See Table 57.)

Case clusters examined by vessel provenience.

Two of the shapes (Copador open and recurved bowls) had sufficient cases to do an analysis of the distribution of the clusters by archaeological provenience of the vessels. It was necessary to collapse provenience data into a two-way split -- Copan Valley versus all others -- since the non-Copan specimens came from so many different sites. Also, a number of pieces from the Popol Vuh museum whose provenience was unknown could not be used in this analysis. The data available, then, allow an examination of the ceramic material according to the criteria of whether the manufactured piece left the Copan Valley or was "consumed" there. The working assumption is that the majority of Copador ceramics and a lot of Gualpopa ceramics were produced in the Copan Valley. Could there have been different decoration standards for "export" pieces as opposed to vessels retained for local (i.e., valley-wide) consumption? If so, this would appear in a differential distribution of clusters by provenience.

Table 58 presents the results of these tabulations (unknown provenience and unclustered cases are shown for completeness). The chi-square statistic was computed for each set of data and is shown in the same table. The chi-square value for open bowl category was not significant. That for the Copador recurved bowls, however, was significant at the .05 level but not at the .01 level. An examination of the X^2 computations showed that the cells representing cluster 3 contributed the most to the achieved X^2. That cluster contained much variabiality which is interesting in light

TABLE 55

Frequency Distribution
Copador Open Bowls By Cluster
Classified By Sharer's Motif-Based Varieties

Sharer Classification	Cluster 1	2	3	4	5	Total
	N=24	N=6	N=8	N=6	N=2	N=46
Glyphic A	8	-	-	-	-	8
Glyphic B	13	-	-	-	-	13
Glyphic C	-	-	-	-	-	-
Glyphic E	-	-	-	-	-	-
Figure A	1	1	1	-	1	4
Figure B	-	-	-	-	-	-
Variations on Glyphic A	-	-	2	1	1	4
Variations on Glyphic B	1	-	-	-	-	1
Variations on Glyphic C	-	2	-	-	-	2
Variations on Glyphic E	-	-	-	3	-	3
Variations on Figure A	-	-	4	-	-	4
Variations on Figure B	-	-	-	-	-	-
Not classified	1	3	1	2	-	7

TABLE 56

Frequency Distribution
Copador Recurved Bowls By Cluster
Classified By Sharer's Motif-Based Varieties

Sharer Classification	Cluster 1	2	3	Not Grouped	Total
	N=8	N=31	N=25	N=3	N=67
Glyphic A	3	-	1	-	4
Glyphic B	3	-	-	-	3
Glyphic C	-	5	-	-	5
Glyphic E	-	-	-	1	1
Figure A	-	3	-	-	3
Figure B	-	21	1	1	23
Variations on Glyphic A	-	-	4	-	4
Variations on Glyphic B	-	-	6	-	6
Variations on Glyphic C	-	-	1	-	1
Variations on Glyphic E	-	-	3	1	4
Variations on Figure B	-	-	1	-	1
Not classified	2	2	8	-	12

TABLE 57

Correspondence Between Sharer
Motif-Based Varieties and Case Cluster Results

Sharer Variety	Case Cluster
Glyphic A	Open bowls, Cluster 1 Recurved Bowls, Cluster 1
Glyphic B	Open bowls, Cluster 1 Recurved bowls, Cluster 1
Glyphic C	Recurved bowls, Cluster 2
Glyphic E	variations present but not strong correlation: (Open bowls, Cluster 4) (Recurved bowls, Cluster 3)
Figure A	variations present, but not strong correlation (Open bowls, Cluster 5) (Open bowls, Cluster 4)
Figure B	Recurved bowls, Cluster 2 Not directly assignable: Open bowls, Cluster 2 -- one-register variants Open bowls, Cluster 4 -- plain interior Recurved bowls, Cluster 3 -- plain interior

TABLE 58

Case Clusters By
Vessel Provenience

Copador Bowls	Provenience: Copan Valley	All Other Provenience	(Unknown Provenience)	Total
Open				
Cluster 1	14	4	(6)	24
Cluster 2	4	1	(1)	6
Cluster 3	4	3	(1)	8
Cluster 4	3	2	(1)	6
Cluster 5	1	1	-	2
Total	26[a]	11[a]	(9)	46
Recurved				
Cluster 1	2	4	(2)	8
Cluster 2	14	14	(3)	31
Cluster 3	18	5	(2)	25
Unclustered	3	-	-	3
Total	37[b]	23[b]	(7)	67

[a] X^2 = 2.61 (4 degrees of freedom; .01 = 13.28, .05 = 9.49)
[b] X^2 = 6.21 (2 degrees of freedom; .01 = 9.21, .05 = 5.99)

of the fact that more of these vessels than expected stayed in the Copan Valley. If this finding were substantiated by further work, it would indicate that the "export" product was more standardized than that made for local consumption.

Univariate tabulations were then made of the motif combinations found on each exterior register of the Copador recurved bowls and on the interior wall register for the two provenience subsamples. Table 59 shows these data along with the obtained X^2 value. Both interior motifs and motifs in register 2 were significantly associated with provenience.

An examination of the motif distributions showed that there was a tendency for more of the vessels with plain interiors to have a Copan provenience than would have been expected. In terms of motif combinations used on the second register of the exterior, neither swimming figures nor effigies were found on vessels with other than Copan provenience.

Even though the pattern of motif combinations for register 1 did not show a significant connection with provenience, there seemed to be a tendency for Copan provenience vessels more often to use glyphs, while "export" bowls had seated figures. This ties together with two considerations:

1) Swimming figures and glyphs have a strong association on Copador open bowls.

2) Seated figures (and solid painted second registers) were a strong modal pattern on Arambala recurved bowls, all found outside the Copan Valley and hypothesized to be derivative of Copador. It is thought that perhaps the seated figure represents a symbolic sharing in Maya tradition (priest/ruler/general authority figure) which would have been important to households in the importing area.

The weighting of plain interior vessels toward a Copan provenience could be interpreted in terms of a greater investment in decoration for export vessels. However, a tabulation of rim diameter versus interior decoration showed that, to a large extent, plain interiors are concentrated on smaller orifice vessels -- a reflection of mechanical rather than stylistic considerations. (See Table 60.) (Medium width rim diameter bowls do show a greater frequency of decoration on non-Copan vessels but the X^2 value is not significant at the .05 level.) The tabluation did show, however, that small and medium rim diameter recurved vessels were more likely to have a Copan provenience than were large rimmed vessels, suggesting a selection by size for export.

TABLE 59

Motif Combinations,
Copador Recurved Bowls
By Provenience

Motif	Provenience: Copan Valley	Provenience: All Other Proveniences
Interior wall		
Plain slipped	19	4
Any glyphs	4	6
Bird	14	13
Total	37[a]	23[a]
Register 1, exterior		
A, B, C Glyphs	16	8
Seated figures	13	12
Serpent/bird	3	3
All other motifs	5	0
Total	37[b]	23[b]
Register 2, exterior		
Solid painted	17	14
Monkey	2	1
Swimming figure	7	0
Effigy	5	0
Geometric design	5	3
All other motifs	1	5
Total	37[c]	23[c]

[a] $x^2 = 7.40$ (2 degrees of freedom; .01 = 9.21, .05 = 5.99)
[b] $x^2 = 4.58$ (3 degrees of freedom; .01 = 11.34, .05 = 7.82)
[c] $x^2 = 13.25$ (5 degrees of freedom; .01 = 15.09, .05 = 11.07)

TABLE 60

Interior Decoration of Copador Recurved Bowls By Rim Diameter -- Copan Provenience versus All Other Proveniences

	Rim Diameter			
	Small (8-11 cm)	Medium[a] (12-16 cm)	Large (17-24 cm)	Total
Copan Valley				
Plain interior	10	9	-	19
Decorated interior	-	7	11	18
Total	10	16	11	37
All other proveniences				
Plain interior	-	2	2	4
Decorated interior	-	6	13	19
Total	0	8	15	23

a X^2 value for this rim diameter subsample between provenience and interior decoration is 2.107. With 1 df, .01 = 6.64; .05 = 3.84.

CHAPTER 6

DISTRIBUTION AND CONSUMPTION OF THE CERAMICS

INTRODUCTION

Trade and exchange are widely used terms in archaeological literature since the early days of the discipline. In recent times interest in this topic has escalated probably for a variety of reasons.

As Renfrew (1975) has pointed out, trade is an activity that relates the material and the social or "spiritual" systems. "It requires organization as well as commodity, and it implies criteria of value and measure. The crucial importance of the study of trade today is that it offers a practical way of investigating the organization of society in social terms as well as purely in economic ones" (ibid:4). Added to this theoretical appeal are methodological concerns. Certainly, one of the contributing factors has been the development of new technical analyses to provide information on the distribution of materials from determined sources. A similar stimulus has been the geography based quantitative methods used to generalize about distribution patterns.

As exchange[14] studies have proliferated, a general approach has emerged. Basic to the study of exchange is determining that an item was exchanged and describing its pattern of distribution in space and time. The next step has been to identify how that distribution occurred: what mode of exchange or mechanism produced the observed pattern. A final objective has been to relate the mode of exchange to the

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[14]Throughout this chapter I use the term exchange to signify the peaceful transfer of goods or commodities. Archaeologists often tend to use trade and exchange almost interchangeably. However, trade is used by many economic anthropologists to mean market trade "the play of supply and demand outside the social and political sphere" (Hodder 1980: 151). Since I am not investigating the question of embedded exchange versus disembedded trade I use "exchange" in the broad, inclusive sense.

organization of the society. However, recently researchers are realizing that different modes of exchange can produce the same spatial pattern. Without restating the mathematical bases, let me summarize the recent positions taken by two archaeologists whose work has emphasized the study of spatial patterning and exchange processes, Colin Renfrew and Ian Hodder. The work which has led to these positions is summarized orreferenced in their cited publications. Renfrew (1977a:88) in contrast with an earlier statement (1975) concludes that:

1. Central place redistribution and central place market exchange are spatially identical.

2. The two central place modes should be distinguishable from symmetrical, homogeneous reciprocal exchange networks.

He believes that a useful field for further study is the range of organizational devices through which the law of monotonic decrement[15] is circumvented by human exchange systems, particularly those that are hierarchically structured.

Hodder (1980) states:

1. Very different exchange processes can produce the same fall-off curve (the same as Renfrew's first conclusion).

2. Even major differences between reciprocal and redistributive exchange may not be reflected in distinctive fall-off curves (contrary to Renfrew's second conclusion).

He believes, moreover, that there are some basic distinguishable types of fall-off curves that seem related to the value of exchange items and social or political boundaries (a curve with distinct "plateaus and kinks.") He concludes that the summary of a total exchange distribution into one fall-off line seems inadequate. He believes there is a need for a combination of detailed and intensive survey (to obtain the fullest

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[15]Defined by Renfrew (1977a:72) as "In circumstances of uniform loss or deposition, and in the absence of highly organized directional (i.e., preferential, nonhomogeneous) exchange, the curve of frequency or abundance of occurrence of an exchanged commodity against effective distance from a localised source will be a monotonic decreasing one."

distributional data), typological studies (to understand variation within the distribution), and study of the context of where the exchanged items are found (to evaluate social aspects of the distribution).

Thus, both of these archaeologists are advocating examining in much more detail data related to the observed spatial distribution before classifying that distribution in terms of a mode of exchange and relating that mode to the societal organization.

Acknowledging the complexity involved in studying exchange systems, the question arose as to what would be feasible to evaluate from the standpoint of the data base for the southeastern Maya periphery painted ceramics. First of all, it was felt that Chilanga, Gualpopa, and Arambala should be eliminated from this part of the study: Chilanga because it represents a much longer time period; Gualpopa and Arambala because their poor description in the literature precludes plotting distribution with any degree of certainty. Thus, the analysis would be restricted to Copador.

Efforts were concentrated on the spatial distribution of the ceramics in order to determine the size of the exchange system within which they functioned. The basic analysis was done using a presence/absence classification. Additionally, a qualitative assessment of frequency of occurrence at various proveniences was made to evaluate the magnitude of the exchange system, one of the characteristics that Plog (1977) states is important in order to understand the organization of an exchange network.

Following on Hodder's observation about the importance of context for understanding the role of the exchange item, several other analyses were undertaken for Copador:

1. Evaluation of the pattern of distribution within the Copan Valley settlement based on survey data to determine if there was a variation in access to the polychrome within its zone of production and, if so, if the variation seems related to status (inferred by classification of settlement type and closeness to the center). This work was augmented by a quantitative analysis of various types of Late Classic polychrome sherds recovered from excavations of three different sized residential groups located in the central area of the Copan Valley near the public center.

2. Evaluation from site survey data of the distribution by type of site within the

Zapotitan Valley, El Salvador, to determine if, in an importing area, there is a variation in access according to site size hierarchy.

3. Evaluation of Copador's role as a valuable item in burials and tombs in Copan.

SPATIAL DISTRIBUTION, COPADOR

Methodology

Area studied

The general distribution area for Copador has usually been described as the Copan area and western El Salvador with isolated occurrences in Guatemala. To assess the accuracy of these impressions it was decided to systematically review information about the archaeology of all of Honduras and El Salvador as well as of certain departments in Guatemala. The section of Guatemala that seems pertinent to the distribution issue is the culture area described by Borhegyi (1965) as the Semiarid Eastern Lowlands (the departments of El Progresso, Jalapa, Jutiapa, Chiquimula, and part of Zacapa). To this was added Santa Rosa and the parts of Izabal which include the Lower Motagua Valley. (Figure 28 shows that part of the southern Maya area studied in this portion of the research.)

The main (central) part of the southern lowlands was not included in the distribution analysis. There is a physical break between the Motagua Valley and the Peten area caused by the Sierra de las Minas, the Lake Izabal depression, and the Negro and Polochic Rivers (Leventhal 1981). Ceramically, the southern lowlands are quite distinct from the southeast area; Copador has never been reported at sites in the lowland region.[16] While some stylistic antecedents for certain Copador motifs may be found on earlier Peten polychromes, it seems well established that actual Copador pieces did not reach the southern lowlands area.

Methods and Procedures

All sites with Late Classic occupation were identified through a combination of literature search, museum study, and consultation with colleagues engaged in recent or on-going projects in the area of interest.

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[16]Two bowls from Piedras Negras are painted with Copador designs and use specular hematite paint. An examination of the paste indicated that it was not cream paste and that the bowls were calcite tempered. Thus they probably were locally made copies of Copador.

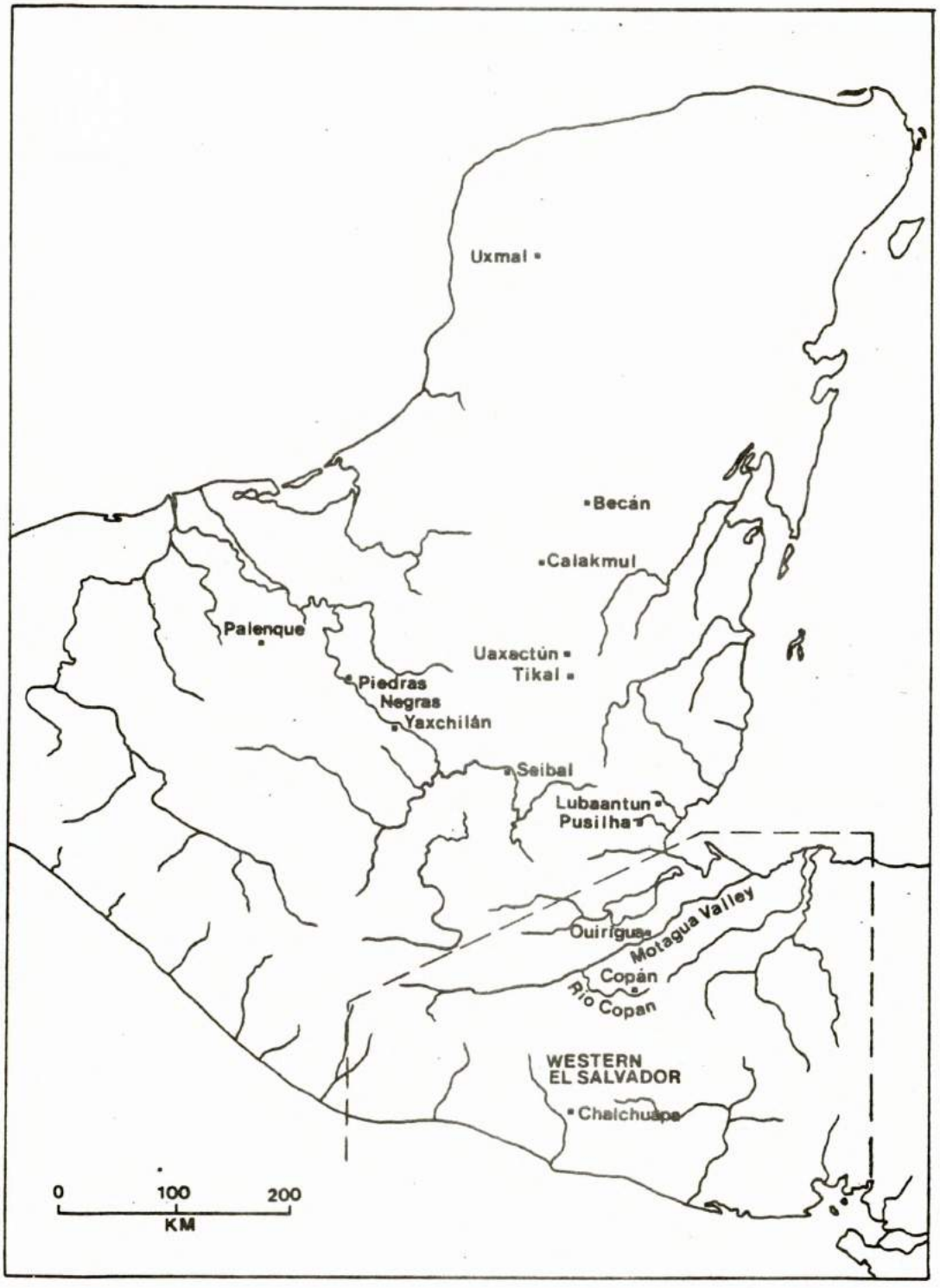

Figure 28: Southern Maya Area Studied In Distribution Analysis

From the literature, all sources that could be found for each site were studied; illustrations as well as text were carefully reviewed. With earlier work more reliance was placed on description and illustration than on any classification that had been made. If the description and illustration fit the type as it now is defined, a presence was recorded regardless of what the original investigator had called the piece.

At the national museums whole pieces were examined, as described in Chapter 3. The National Museum in Guatemala also houses sherd collections from both surface collections and excavation projects. These were examined for the part of the country just described. The National Museum in El Salvador maintains a site register which can carry notes about cultural materials observed when recording the location.

Archaeologists working in the Copan Valley, the middle and lower Motagua Valley, the Sula Plain (Honduras) and the Cerron Grande area (El Salvador) made available their records of Late Classic occupied sites and their ceramic inventory.

The procedure was to develop a record card for each site with Late Classic occupation. Note was made of 1) the location of the site as described in the source, 2) map coordinates, 3) summary description of the site -- size, public construction, etc., 4) summary description of ceramics, including polychrome types, and 5) bibliographic references.

From this index file, all Late Classic sites were plotted and identified according to the presence or absence of Copador. (See Figure 29.) The area was then gridded, using Copan as the center point, and a point pattern analysis was done (Hodder and Orton 1976:30-43). A quadrat of 50 sq. km. was selected as the unit for analysis. (See Figure 30a and b.) This size was arrived at empirically. A smaller quadrat of 25 sq. km. resulted in too many empty units; a larger unit did not seem justified given the total size of the distribution area. (Hodder and Orton 1976:37 discuss this problem of the size and the shape of a selected quadrat and the effect on the resulting analysis.)

Limitations

Before proceeding to review the results of the point pattern analysis some circumstances which limit the findings should be mentioned:

1. Extreme variability in the type of report available. The reviewed literature spans 75 years of archaeology. Some information came from synthesizing articles in which only general statements were made about a

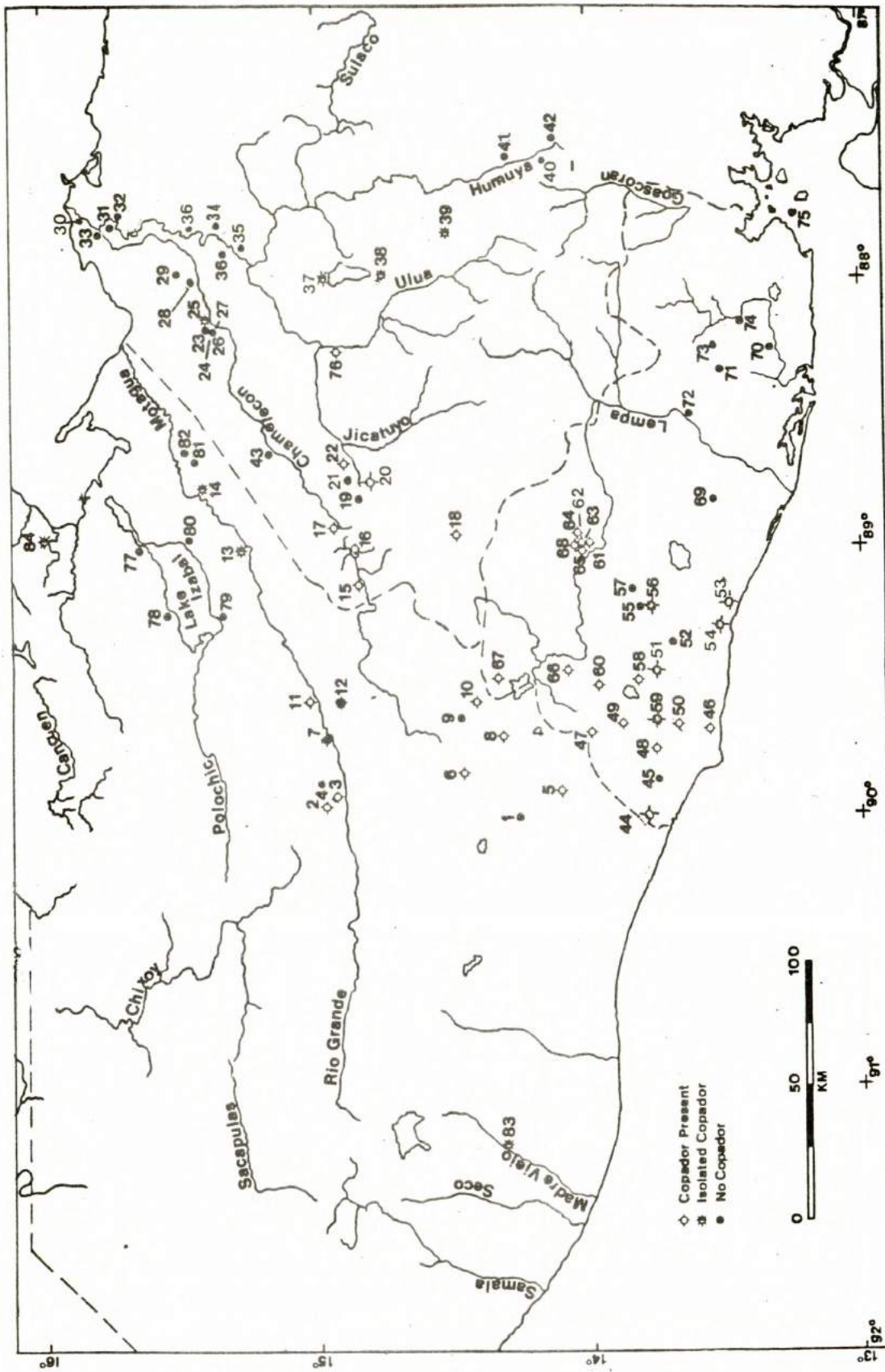

Figure 29: Late Classic Sites with Presence or Absence of Copador noted

NOTE: Table 61 contains a key to the numbered sites

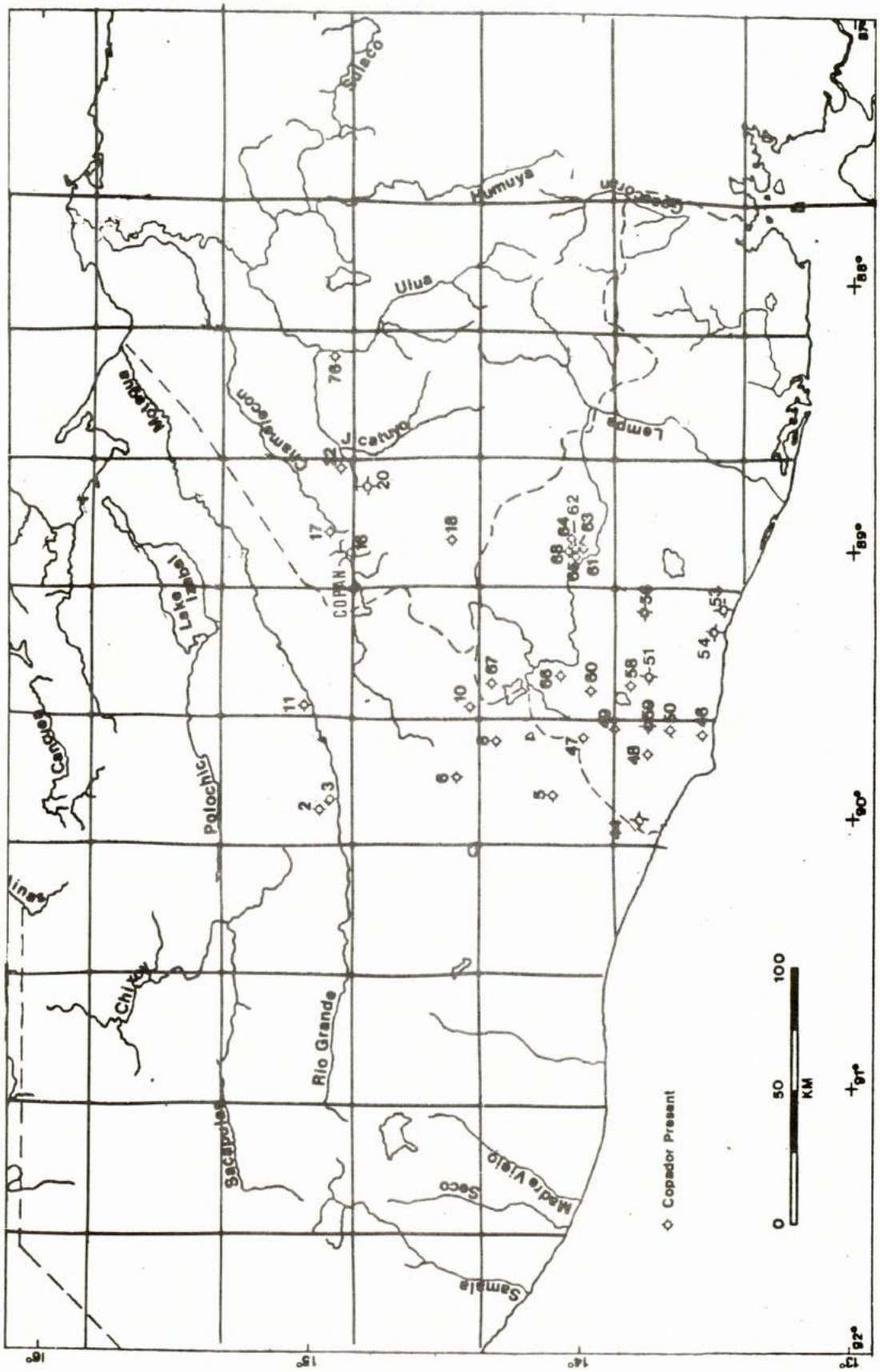

Figure 30A: Late Classic Sites, with Copador, Gridded by Distance From Copan (50 sq. km. Radius Units)

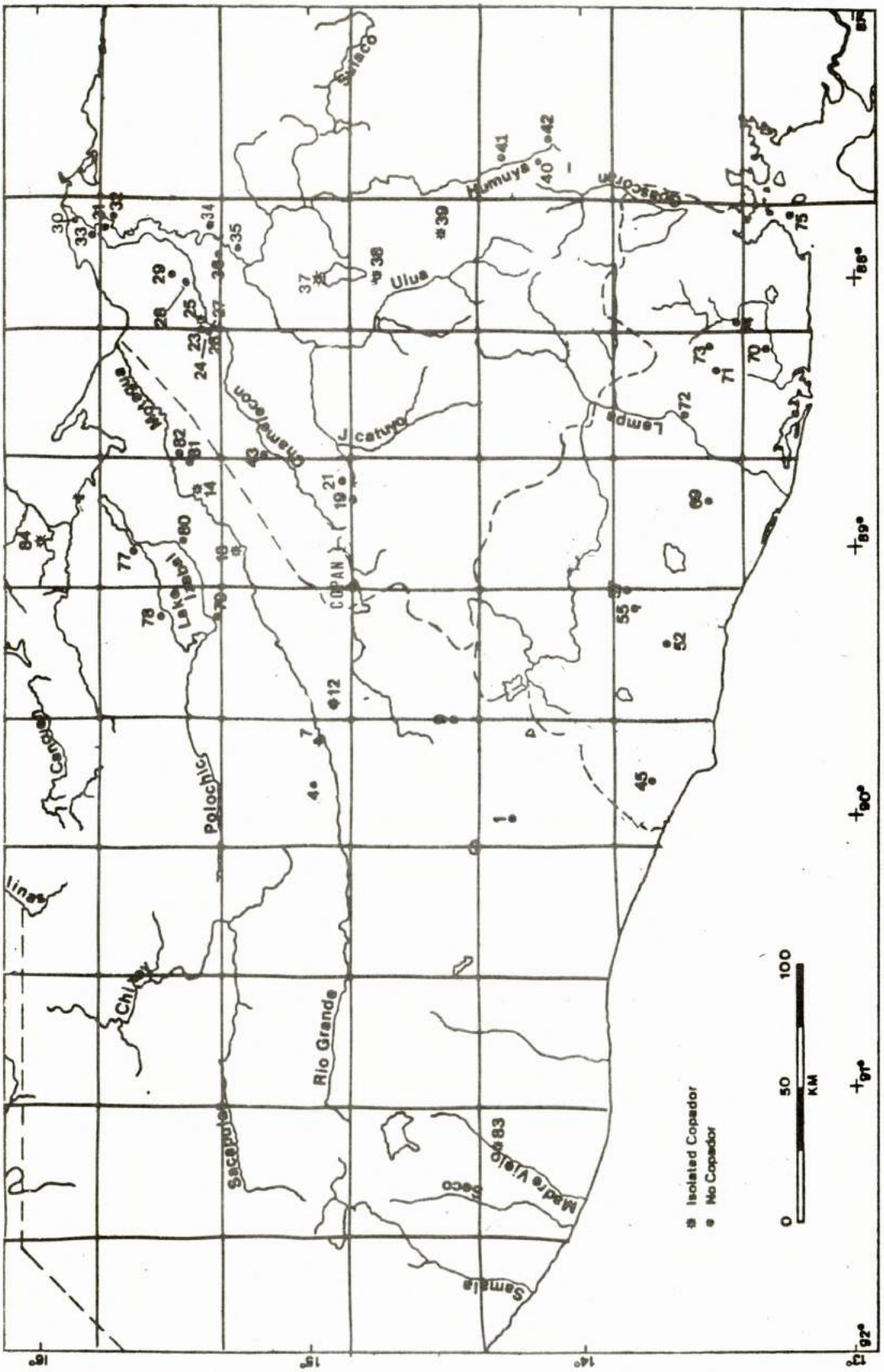

Figure 30B: Late Classic Sites, with Isolated or No Copador, Gridded by Distance From Copan (50 sq. km. Radius Units)

TABLE 61

Late Classic Sites Shown In Figures 29 and 30

Site Number in Figure	Site Name	Department	Country
1	El Valle	Jutiapa	Guatemala
2	San Agustin Acasaguastlan	El Progresso	Guatemala
3	Guaytan (El Teron Magdalena, Tulumaje	El Progresso	Guatemala
4	Los Cimientos	El Progresso	Guatemala
5	Las Pilas (Comapa)	Jutiapa	Guatemala
6	La Campana	Jalapa	Guatemala
7	La Vega de Coban	El Progresso	Guatemala
8	Asuncion Mita	Jutiapa	Guatemala
9	Papalguapa	Jutiapa	Guatemala
10	El Barrital	Jutiapa	Guatemala
11	Rio Hondo	Zacapa	Guatemala
12	El Jicaro	Zacapa	Guatemala
13	Quirigua	Izabal	Guatemala
14	Playitas	Izabal	Guatemala
15	Copan	Copan	Honduras
16	Rio Amarillo	Copan	Honduras
17	Santa Rita de Copan	Copan	Honduras
18	Sensenti	Ocotopeque	Honduras
19	Paraiso	Copan	Honduras
20	La Florida	Copan	Honduras
21	El Puente	Copan	Honduras
22	Quesailica	Copan	Honduras
23	Naco	Cortes	Honduras
24	El Regadillo	Cortes	Honduras
25	La Sierra	Cortes	Honduras
26	Descalzada	Cortes	Honduras
27	Monte Grande	Cortes	Honduras
28	Tres Piedras	Cortes	Honduras
29	Calpules	Cortes	Honduras
30	La Lima	Cortes	Honduras
31	Tehuma	Cortes	Honduras
32	Las Flores	Cortes	Honduras
33	Playa de los Muertos	Cortes	Honduras
34	Travesia	Cortes	Honduras
35	Rancheria	Cortes	Honduras
36	Santa Rita	Cortes	Honduras
37	Los Naranjos (Jaral, El Eden, La Cieba)	Santa Barbara	Honduras
38	Taulabe	Comayagua	Honduras

TABLE 61 (continued)

Site Number in Figure	Site Name	Department	Country
39	Siguatepeque	Comayagua	Honduras
40	Yarumela	Comayagua	Honduras
41	Tenampua	Comayagua	Honduras
42	Las Vegas	Comayagua	Honduras
43	Los Higos	Copan	Honduras
44	Cara Sucia	Ahuachapan	El Salvador
45	El Cajete	Ahuachapan	El Salvador
46	Nahulingo	Ahuachapan	El Salvador
47	Chalchuapa Zone	Santa Ana	El Salvador
48	Izalco	Sonsonate	El Salvador
49	Escalante	Ahuachapan	El Salvador
50	Tula	La Libertad	El Salvador
51	Escula	La Libertad	El Salvador
52	Colon	La Libertad	El Salvador
53	Punian	La Libertad	El Salvador
54	Costa del Balsamo	La Libertad	El Salvador
55	Nejapa	San Salvador	El Salvador
56	Club Internacional	San Salvador	El Salvador
57	Hacienda de la Patrocinia	Suchitoto	El Salvador
58	Campana San Andres	La Libertad	El Salvador
59	Cujagualo	La Libertad	El Salvador
60	San Jorge	Coatepeque	El Salvador
61	Los Arcos	Chalatenango	El Salvador
62	El Tamarindo	Chalatenango	El Salvador
63	La Cienega	Chalatenango	El Salvador
64	La Criba	Chalatenango	El Salvador
65	El Tanque	Chalatenango	El Salvador
66	Hacienda San Diego	Santa Ana	El Salvador
67	Belen Guyat II	Santa Ana	El Salvador
68	El Remolino	Cuscatlan	El Salvador
69	Tehuacan	San Vicente	El Salvador
70	Los Llanitos	San Miguel	El Salvador
71	Chinameca	San Miguel	El Salvador
72	Estanzuelas	Usulutan	El Salvador
73	Quelepa	San Miguel	El Salvador
74	Rio Ojos de Agua	San Miguel	El Salvador
75	Conchagua Vieja	La Union	El Salvador
76	Gualjoquito	Santa Barbara	Honduras
77-80	Unamed minor centers around Lake Izabal	Izabal	Guatemala
81	Las Quebradas	Izabal	Guatemala
82	Quebrande Grande	Izabal	Guatemala
83	Tiquisate area	Escuintla	Guatemala
84	Pusilha		Belize

time period and ceramic inventory. Other data were retrieved from detailed site reports. Because of this inconsistency of detail, it was necessary to use only the broadest, or lowest, level of input, namely presence or absence. Initially, it had been hoped that some type of analysis could be done in terms of provenience within a site or quantity at a site -- both of these analyses had to be abandoned because of lack of data.

2. Variability in collection method or mode of observation. Some early reports are based upon pieces in private collections (often of the landowners on whose property the site was located). Fortunately, Copador, as a polychrome, probably had a good chance of being saved -- a much better chance than if the ceramic of interest were coarse ware. Nevertheless, attributing presence or absence on the basis of scant data like this can be highly conjectural. Similarly, surface collections may not disclose the full range of a site's ceramic inventory. Thus, there is a great deal of uncertainty associated with concluding that lack of a presence equals an absence. Consequently, an attempt has been made to not "over analyze" the data. The observed spatial distribution will be considered as a trend or probable pattern. No attempts were made to apply quantitative methods to the data.

3. Variability in coverage of the geographic area. Certain parts of the geographic region considered in the distribution analysis have not been investigated by any type of archaeological study as can be seen by the lack of recorded Late Classic sites in certain quadrats of the map. The possibility cannot be overlooked that settlements in these areas, when and if they are discovered, will contain Copador ceramics. Fortunately, as will be discussed shortly, the direction of the distribution seems quite clear, even with these lacunae.

At the other extreme, a few sections of the area included in the distribution analysis have been extensively covered by recent survey projects -- the Zapotitan Valley in El Salvador, the lower Motagua Valley in Guatemala, and the Copan Valley in Honduras. Many of the sites identified in these recent projects are very small house mound groups that had not been recorded in

earlier work within the region. In order to not "swamp" the data set with observations from these parts of the region, all the individual sites have not been entered on the distribution map. The pattern of Copador distribution within two of these thoroughly studied zones -- the Copan Valley and the Zapotitan Valley -- will be dealt with in detail in a later section of this chapter.

Findings

Magnitude of Distribution

Although the data were recorded only for the presence or absence of Copador, an indication of the quantity being distributed can be determined from the proportion of the Late Classic sites having the polychrome. Copador was present at a total of 41.0 percent of the Late Classic sites (Table 62). Site size is not known in all cases, but there are ample indications that Copador was not restricted to large sites with a considerable amount of public architecture nor to elite residential loci. These aspects of distribution will be covered shortly. Suffice for now to say that distribution to as many locations as are indicated by this analysis would necessitate an efficient system for moving the pottery and would infer a sizable production capacity.

Distance of Distribution

Disregarding the direction of the distribution for a moment, the fall-off in the presence of Copador is quite sharp beyond a 100 sq. km. radius of Copan. (See Figure 31.) It is interesting to note that the percentage of sites with Copador is approximately equivalent within a 50 sq. km. radius and between 50 to 100 sq. km.

Direction of Distribution

When the distribution of Copador was examined on the basis of general direction from Copan (NE, SE, NW, SW), a pattern of directionality emerged (Table 62). There is a decided western skew to the distribution, with the southwest being the definite preferred direction of movement. The northwest quadrat does not cover as much space as the other quadrats because of the way in which the study area was defined. The northeast quadrat is also somewhat truncated in size because of geography; the Caribbean coast limits the area. In spite of these inequalities in the size of the quadrats, the directional tendency is quite distinct and observable on a qualitative basis.

The strength of the directionality is more apparent when distance from Copan is considered along

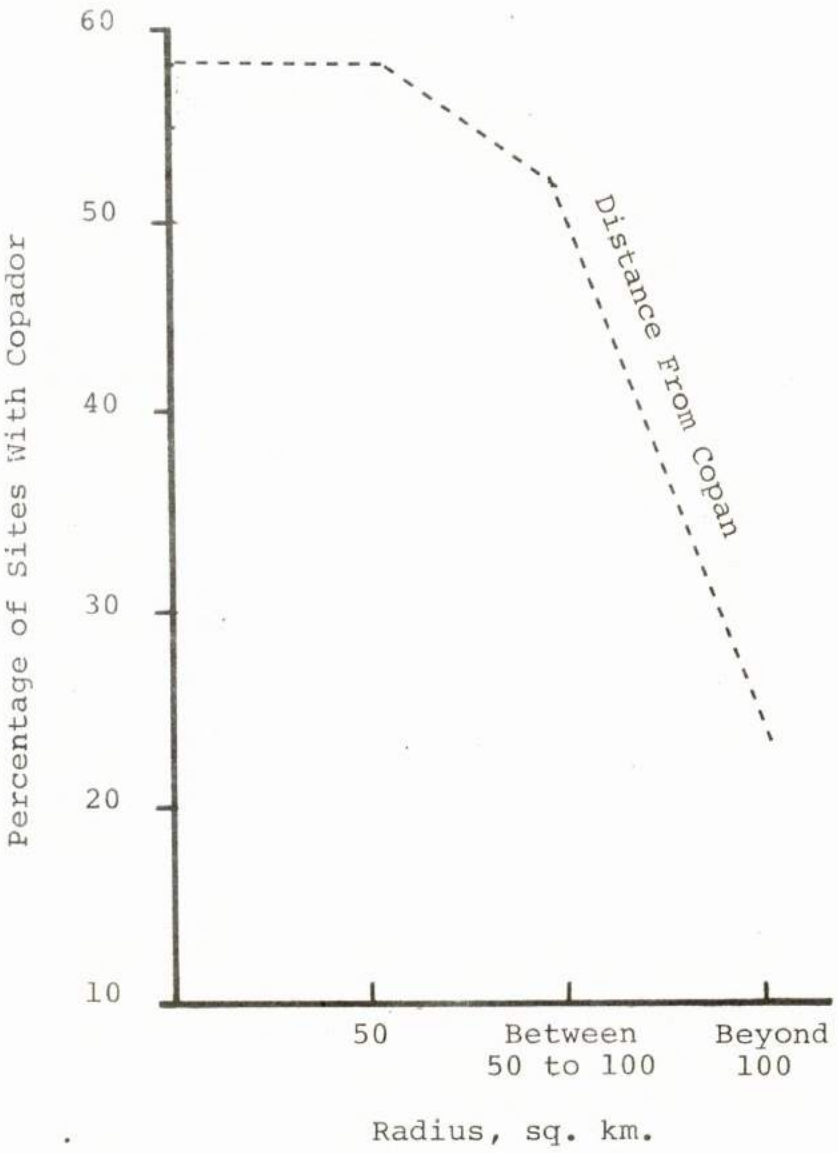

Figure 31: Falloff in Presence of Copador by 50 sq. km. Radius Units

TABLE 62

Location Of Late Classic Sites Vis-A-Vis Copan[a]

Location	Sites With Copador		Sites Without Copador		Total Sites
	N	%	N	%	N
Southwest	19[b]	76.0	7	24.0	25
Northwest	3	37.5	5	62.5	8
Southeast	8[c]	36.4	12	60.0	20
Northeast	4[d]	14.3	26	86.7	30
Total	34	41.0	49	59.0	83

[a]Copan is excluded from all counts.
[b]One isolated sherd of Copador was found in the Tiquisate area of Guatemala. This area was not included in the count for sites with Copador, rather it is included in the without Copador cell.
[c]Three additional sites in each of these sectors had either isolated Copador finds or were where early investigators had referred to "Copador-like" ceramics. These sites were not included in the count for sites with Copador, they are included in the frequency and percentage for sites without Copador.
[d]Four additional sites had isolated Copador finds; they are included in the without Copador cell.

with compass directions (Table 63). Within a 50 km radius from Copan, very little, if any, directional preference is noted. In the 50 to 100 km radius band, the southern orientation is beginning to emerge, with the majority of the distribution in that direction -- both southwest and southeast. Beyond the 100 km radius, all of the known occurrences are concentrated within the southwest quadrat. The southeast area is not within the distribution zone at this distance.

Thus, the long distance distribution of Copador was firmly tied to settlements in western and central El Salvador, as well as to some in the mountainous region near the Guatemala - El Salvador border. It is interesting to note that several Guatemalan sites with Copador are near the large Ixtepeque obsidian source used in pre-Columbian times.

The focus of the discussion up to this point has been on the location of sites classified as having a Copador presence beyond just an isolated example or

TABLE 63

Directional Location
Of Late Classic Sites And Distance
From Copan[a]

Radius, km	Sites With Copador	Sites Without Copador	Total Sites
Within 50			
Southwest	1	-	1
Northwest	1	1	2
Southeast	2	0	2
Northeast	3[b]	4	7
50 to 100			
Southwest	7	2	9
Northwest	2	4	6
Southeast	6	-	6
Northeast	1[b]	9	10
Beyond 100			
Southwest	10	5	15
Northwest	0	0	0
Southeast	0[c]	12	12
Northeast	0[d]	13	13

[a]Copan is excluded from all counts.
[b]One site with isolated Copador finds included in the "without Copador" cell.
[c]Two sites with isolated Copador finds included in the "without Copador" cell.
[d]Three sites with isolated Copador finds included in the "without Copador" cell.

two. Some comments on the location of sites with reported isolated Copador finds are in order:

Northeast sites (Quirigua, Las Playitas, and La Sierra). At both Quirigua, a Middle Motagua site, and Las Playitas, in the Lower Motagua area, only a few isolated Copador sherds were recovered. (At Quirigua, only 39 Copador sherds were uncovered in five seasons of excavations in both the site core and the site periphery [W. Ashmore, personal communication, 1980].) As covered in Chapter 2, the chemical composition of cream wares from these sites did not match that of the main body of materials thought to be the result of production in the Copan Valley. Consequently, the presence of Copador-style ceramics in this area probably does not represent distribution from Copan. As a sidelight it is interesting to note that polychrome ceramics are largely lacking both at Quirigua, which has most of the hallmarks of a Late Classic Maya center, and at major centers on the Lower Motagua which lack many Maya features (Ashmore and Sharer 1978; Schortman 1980).

La Sierra, located on the banks of a large branch channel of the Rio Chamelecon in the Ulua Valley, is the only site on the more northerly courses of the Chamelecon or Ulua Rivers where any Copador has been found. (Gualpopa and Chilanga also are mentioned in the reported ceramic inventory as are "polychromes in the Ulua Valley tradition" [Henderson et al. 1979].) It is possible that this large, regional center did occasionally receive imported ceramics from Copan even though it is away from the mainstream of distribution.

Southeast sites (Los Naranjos, Taulabe, Siguatepeque). Only one of these sites, Los Naranjos, has been thoroughly investigated (Baudez and Becquelin 1973). This archaeological zone at the northern end of Lake Yojoa produced only a handful of Copador sherds. The dominant Late Classic polychrome group from Los Naranjos, Babilonia Polychrome (see Appendix B for a description), on the other hand, has been relatively frequently found in the Copan area.

The other two sites -- Siguatepeque and Taulabe -- were visited in the 1930's as part of an archaeological reconnaisance (Yde 1938) and reported on again by Stone (1957). Yde describes polychromes in the Ulua-Yojoa tradition at Siguatepeque and for Taulabe only states that "lots of pottery was found and sold." Stone emphasizes the Ulua-Yojoa types at both sites but adds "Copador" or "Copador style" to the list of ceramics observed. At the time her work was done, Copador had not been fully described by Longyear from the Copan materials. It is possible that a reexamination of the pieces (they are not illustrated in her work) would

lead to their reclassification or to their being reprovenienced as happened with some of the Los Naranjos material (Baudez and Becquelin 1973:274,279).

Other. Tiquisate area (coastal Guatemala) -- An isolated find was reported by Shook (1965) as coming from this area. One sherd was located in the Museo Nacional in Guatemala City and sampled for chemical composition. Its paste fit into the Copan-focus reference group, as described in Chapter 2. Thus, while it seems to have been made in the Copan Valley, little can be said about such an isolated find in this remote an area.

Pusilha (Belize) -- Early visits to this Southern Belize site uncovered stelae that allied the settlement to Late Classic Maya centers and pottery that showed stylistic similarities with the southeastern periphery. The location is so geographically removed from Copan, however, that it is difficult to hypothesize the nature of the interaction. It will be recalled that 10 of the 19 Pusilha Copador samples analyzed for chemical composition fit well into the Copan-focus reference group while the others diverged in varying ways. Since the sherds were not examined in person nor sampled by Brookhaven researchers, the reasons for the deviations cannot be appraised. It is hoped that planned excavation at the site (Leventhal, personal communication, 1982) will provide a data base for answering some of these questions.

Finally, some comments can be made about the parts of the study area to which Copador was not distributed. Western Honduras is the only part of that country where the type is reported with any degree of regularity. None of the sites along the lower courses of the Ulua or Chamelecon rivers yielded Copador materials. The Comayagua Valley is east of the distribution zone as is eastern El Salvador.

Conclusions

The distance over which Copador moved from the primary distribution center of Copan is substantial. Similarly, the quantity that was distributed, as reflected by the proportion of sites with other than isolated evidence, was sizable. Both of these characteristics of the exchange system require an efficient distribution system which provides a regular supply of the product to consumers located as far as 100 km from the distribution center.

The spatial distribution of Copador serving vessels shows a decided directionality. This is not a case of a symmetrical, homogeneous, reciprocal exchange in which Renfrew's law of monotonic decrement would be

expected to operate. the lack of spatial symmetry establishes Copador's distribution as one described by Ericson (1977:110) as being inappropriate for "two dimensional" analysis of distance-dependent trends. If quantitative analysis were to be undertaken, this factor would have to be considered.

The directionality is clearest beyond a 50 km radius from the main distribution center of the Copan Valley. Long-distance distribution was concentrated to the southwest of the Copan Valley, in the western and central parts of El Salvador. copador was not distributed into the populous areas of Honduras to the east of the Copan Valley -- neither to Quirigua and its affiliated Lower Motagua settlements nor to any part of the Ulua Valley system. The absence of Copador in these two geographic areas probably reflects different sets of economic and social circumstances.

The Ulua Valley, including the Lake Yojoa area, seems to represent successful competition from active local ceramic producers which kept out the Copan imports. The Ulua-Yojoa ceramic producers also were able to distribute their polychromes to the north through the Ulua and Chamelecon valleys to the Caribbean, a region where Copador did not penetrate. The central Honduras ceramics also were distributed to the southeast as far as the Gulf of Fonseca in El Salvador (Beaudry 1982). In fact, as will be discussed in more detail shortly, UluaYojoa polychromes are not uncommon in the Copan Valley. Interestingly, Ulua-Yojoa polychromes are extremely rare in western and west-central El Salvador where Copador is so heavily concentrated.

The absence of Copador at Quirigua and the Lower Motagua sites does not appear to be the result of competition from another material distribution system since no polychrome serving vessels are prominent in these sites' Late Classic ceramic inventories. It seems that inhabitants in the area neither imported nor produced locally this type of ceramic vessel. For some reason, not yet understood, these settlements did not favor, or have access to, polychrome ceramics which are so typical of this time period throughout Mesoamerica and lower. Central America (Healy 1980).

CONTEXT ANALYSIS, COPADOR AND OTHER PAINTED CERAMICS

Distribution Pattern Within the Copan Valley

Methodology

Data for this analysis came from two sources: 1) Harvard University's settlement pattern study of parts of the Copan pocket and 2) The Copan Valley sampling program of the Proyecto Arqueológico Copan.

Harvard University spent two seasons working in the Copan Valley just prior to the inauguration of the Proyecto Arqueológico Copan. The Harvard expedition conducted a preliminary survey of the Valley followed by detailed mapping of individual sites or structure units. Detailed mapping was done in several sectors of the Valley but the primary emphasis was in an area where medium and small size ruin density is very great with a more or less continuous distribution of at least 500 mounds within an area of approximately 1.25 sq. km. (Willey and Leventhal 1979:79). Then, excavations were carried out at three sites representing different levels in a proposed site typology or hierarchy. Ceramic analysis has proceeded to the point where all the material has been sorted by classified type and detailed provenience (including level within an excavation; nature of excavation or trenching operation, etc.). The data have been entered into a computerized data bank from which various subsets of information can be retrieved. Through the kind auspices of the Harvard project staff, listings were procured which provided a tabulation for each painted type along with specified provenience information.

Using these listings it was possible to determine the number of sites (and their typological classification) with each painted type of ceramic, the quantity of each type recovered, and the specific structure or plaza within the site from which the material came.

The Proyecto Arqueológico Copan has completed part of their research wherein the settlement pattern for the entire Copan Valley was investigated through a stratified sampling program. Lot cards from the ceramic analysis of the materials recovered during the program (179 sub-operations) were made available for study at the Project's headquarters in 1981. There were 110 sub-operations for which materials had been collected, sherds classified, and a Coner phase temporal assignment made. The individual lot cards for each sub-operation were then reviewed and tabulations made of the presence and quantities (if recorded) of any of five painted types of ceramics as well as the total number of ceramics in the lot.

The painted types tabulated were Copador, Gualpopa, Babilonia, Caterpillar[17] and Chilanga. Since many of the lot cards did not specify quantity by

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[17]This local Copan Valley type was included in this part of the research since it is the only other Coner phase painted ware present with any frequency in the Valley. A type description is given in Appendix B.

type, it was necessary to analyze these data on the basis of only presence/absence.

Findings

Table 64 summarizes the findings from the Proyecto Arqueologico Copan data in terms of the overall distribution of the painted types in the Valley; Table 65 presents the distribution by specific types. Several possible sources of error in the data should be mentioned. Data were entered on the lot cards as part of the initial laboratory processing of the material. Thorough sherd-by-sherd analysis was not an objective at this stage of the work, thus omission or misclassifications might be made. The types may vary with regard to their likelihood of being overlooked. Copador is probably the least likely to be overlooked since much of its total surface is decorated and therefore easily recognizable. Babilonia's paste and paint colors also render it quite distinguishable. Gualpopa's and Chilanga's larger scaled designs and frequently unpainted interiors could lead to some underrepresentation. Also, Gualpopa might be misclassified as Chilanga if a sherd with only the red painted part of a design were encountered. Caterpillar probably would not be overlooked very often because of its heavy wall, distinctive paste color and use of the easily identifiable specular hematite red paint.

Another source of error could be variation in preservation among the sub-operations since they were located in various types of terrain throughout the Valley. However, the susceptibility of the various painted types to weathering seems fairly consistent. Consequently, if there is any understatement of the materials' presence it probably would be reflected across the types. The relative frequency of occurrence should remain the same.

With these caveats in mind, some observations of the ceramics' distribution can be made:

1. Painted ceramics were widely distributed during the Coner phase occupation. Furthermore, this distribution was found throughout the Copan Valley settlement; painted ceramics were present in all parts of the valley, cutting across the range of social status, size of residential unit, and other cultural factors. A further tabulation was made of sub-operations where all five painted types were present; these proveniences were not concentrated in any certain part of the valley either. Finally, proveniences without any painted ceramics were checked for location. They tended to be away from the archaeological

TABLE 64

Overall Distribution
Of Coner Phase Painted Ceramics
In The Copan Valley
(Sampling Program, Proyecto Arqueologico Copan Data)

Presence of painted ceramics	110 Sub-Operations
Sub-operations, at least one type reported	79.1%
Sub-operations, all five types reported	22.7

TABLE 65

Distribution By Type
Of Coner Phase Painted Ceramics
In The Copan Valley
(Sampling Program, Proyecto Arqueologico Copan Data)

	110 Sub-Operations	
Type reported	With Type	With Only This Painted Type
Copador	65.5%	15.5%
Gualpopa	35.5	1.8
Caterpillar	43.6	.9
Babilonia	32.7	0
Chilanga	53.6	6.4

park (which contains the largest public structures in the valley) and in the mountain or foothill strata rather than on the bottomlands. The absence of painted wares could relate to functional considerations or merely to sampling factors. From the rather limited perspective of this analysis it does not appear to reflect a status-related differential access to painted wares since other sub-operations in equivalent locations did produce painted ceramic materials. A more thorough examination of excavation and surface collection records would be necessary before any definite conclusions could be reached about the significance of the noted absence.

2. Copador was the most frequently represented of the types recorded (65.5 percent

of the sub-operations had Copador). It also could be judged as having been the most easily accessible -- that is, if only one painted ceramic ware were present, most often it would be Copador.

3. Chilanga's presence also was widespread, but, as just mentioned, may be overstated. Conversely, Gualpopa's presence may be understated. There were 24 sub-operations where Chilanga was found but Gualpopa was not. If one assumes that half of those had Gualpopa either along with chilanga or instead of Chilanga, then 51 sub-operations (46.4 percent) had Gualpopa representation. This is still considerably less than Copador (65.5 percent representation) and not what would have been expected. Copador has been assumed to have been a higher status good than Gualpopa because of its more elaborate decorative scheme, use of the distinctive specular hematite paint, assumed assocation of its glyphic elements with the elite, etc. Yet, its wider distribution within the Copan Valley would suggest greater availability, less restriction in its accessibility: the reverse of the expected pattern for a higher status article.

4. Babilonia is assumed to have been imported into the Copan Valley from somewhere in the Ulua-Yojoa area. It is interesting to find it present in almost one-third of the proveniences studied. It was noticed that Babilonia always co-occurred with Copador. It is probable, of course, that a lesser quantity of the imported polychrome is present in the Copan Valley. In fact, in some very large lots for which counts by type were available, the amount of Copador was significantly greater than that of Babilonia.

The Harvard University data were used to amplify and fill in the observations just made from the stratified random sampling program. Some limitations in the Harvard data base should be mentioned. Thorough test excavations were done at three sites: CV-16 (smallest, Type 1 site), CV-20 (medium, Type 2 site), and CV-43 through 47 (larger, Type 3 site). The other sites were mapped and then test pitted with a 2 by 3 meter pit in the center of a plaza. Thus, the data from the test pitted sites can only be considered tentative and must be discussed in terms of trends. Also, plaza test pit samples could be expected to less accurately reflect a site's inventory as site size and complexity increased.

The listing showed that 25 sites investigated during the Harvard project produced Copador ceramics while only eight had Gualpopa and seven had Babilonia (Table 66).

TABLE 66

Distribution of Coner Phase Painted Ceramics
(Sites Mapped and Excavated in Copan Valley
Harvard University Project)

Type	Number of sites reporting this type
Copador	25
Gualpopa	8
Babilonia	7

When the sites are divided according to the site classification hierarchy (Table 67) it can be seen that Copador prevails at all four types of sites while Gualpopa and Babilonia seem to have been restricted to larger sites (that is, excluded from Type 1 sites, N=7).

It seems probable that more extensive excavations would turn up more sites with Gualpopa and Babilonia (the 25:8:7 ratio would be closer). However, it seems likely that these would be other than Type 1 sites. The logic behind this reasoning lies in the observation that at CV-16, the thoroughly investigated Type 1 site, only one sherd of each of the Gualpopa and Babilonia types emerged. Thus, the lack of any Gualpopa and Babilonia at the other six Type 1 test pitted sites could be assumed to reflect "reality" at those small sites.

When the quantities of sherd material from the three excavated sites are examined (Table 68) several trends are seen:

1. Much more Copador was recovered than Gualpopa and even less Babilonia was found.

2. Less Copador was concentrated at the largest site than was the case with Gualpopa and Babilonia. A larger percentage of Copador came from the Type 2 site than was true of the other painted types.

These data, then, support and amplify those from the broader valley sampling program. Copador was more widely distributed and appeared in larger quantities than Gualpopa and Babilonia. Furthermore, Copador was

TABLE 67

Distribution of Coner Phase Painted Ceramics
By Site Classification
(Harvard University Project Data)

Sites grouped by classification	Quantity of Ceramics Recovered		
	Copador	Gualpopa	Babilonia
Type 1			
16	265	1	1
40	14	-	-
91	10	-	-
94	28	-	-
88	19	-	-
125	1	-	-
190	10	-	-
Subtotal by site type	346 (6.8%)	1 (0.1%)	1 (0.2%)
Type 2			
20	1699	100	125
48	3	-	1
84	14	-	-
106	14	10	-
115	-	-	1
135	2	5	-
160	3	1	-
204	69	-	-
205	3	-	-
Subtotal by site type	1807 (35.7%)	116 (12.6%)	127 (22.9%)
Type 3			
13	4	-	-
22	1	-	-
43-47	2741	793	395
56	5	2	-
124	1	-	-
186	4	-	-
Subtotal by site type	2756 (54.5%)	795 (86.6%)	395 (71.3%)
Type 4			
17	116	6	1
68	18	-	-
122	13	-	-
177	4	-	30
Subtotal by site type	151 (3.0%)	6 (0.7%)	31 (5.6%)
Total	5060 (100%)	918 (100%)	554 (100%)

TABLE 68

Quantity of Sherd Material, Excavated Sites

Excavated Sites	Copador	Gualpopa	Babilonia
	N=4705	N=894	N=521
CV 16 (Type 1)	5.6%	0.1%	.2%
CV 20 (Type 2)	36.1	11.2	24.0
CV 43-47 (Type 3)	58.3	88.7	75.8
	100.0	100.0	100.0

available to occupants of smaller residential units while Gualpopa and Babilonia showed some restriction to larger, more complex units (at least in the parts of the Copan Valley covered by the Harvard project).

An examination then was made of the intra-site proveniences for the painted types at each of the three excavated sites. The nature of the field operations from which these data were gathered should be specified. Clearing and trenching was done in both plazas and structures at the three excavated sites. Sherd counts were available from both of these types of operations. The trenching operations, however, represented mainly construction fill which would be of limited usefulness for trying to determine intra-site use of the various ceramics. Thus, only the material from the clearing operations was used. The excavator has said that no middens, per se, were encountered at the sites and his opinion is that debris was disposed of by throwing it off the platform substructure (R. Leventhal, personal communication, 1982). Thus, the sherds from structure clearing would be at least somewhat indicative of building use and will be so employed in the following analysis.

CV-20. This Type 2 site consists of two plazas, the main one enclosed on all four sides by buildings of various heights and sizes. (See Figure 32.) Table 69 shows the percentage of sherds by type by structure.

Several observations are noteworthy:

1. The quantity of Copador is far greater than that of the other two types and its distribution is ubiquitous -- no structure lacked Copador material.

2. The distribution of Babilonia is quite restricted with only a few pieces occurring at other than Structures A and B.

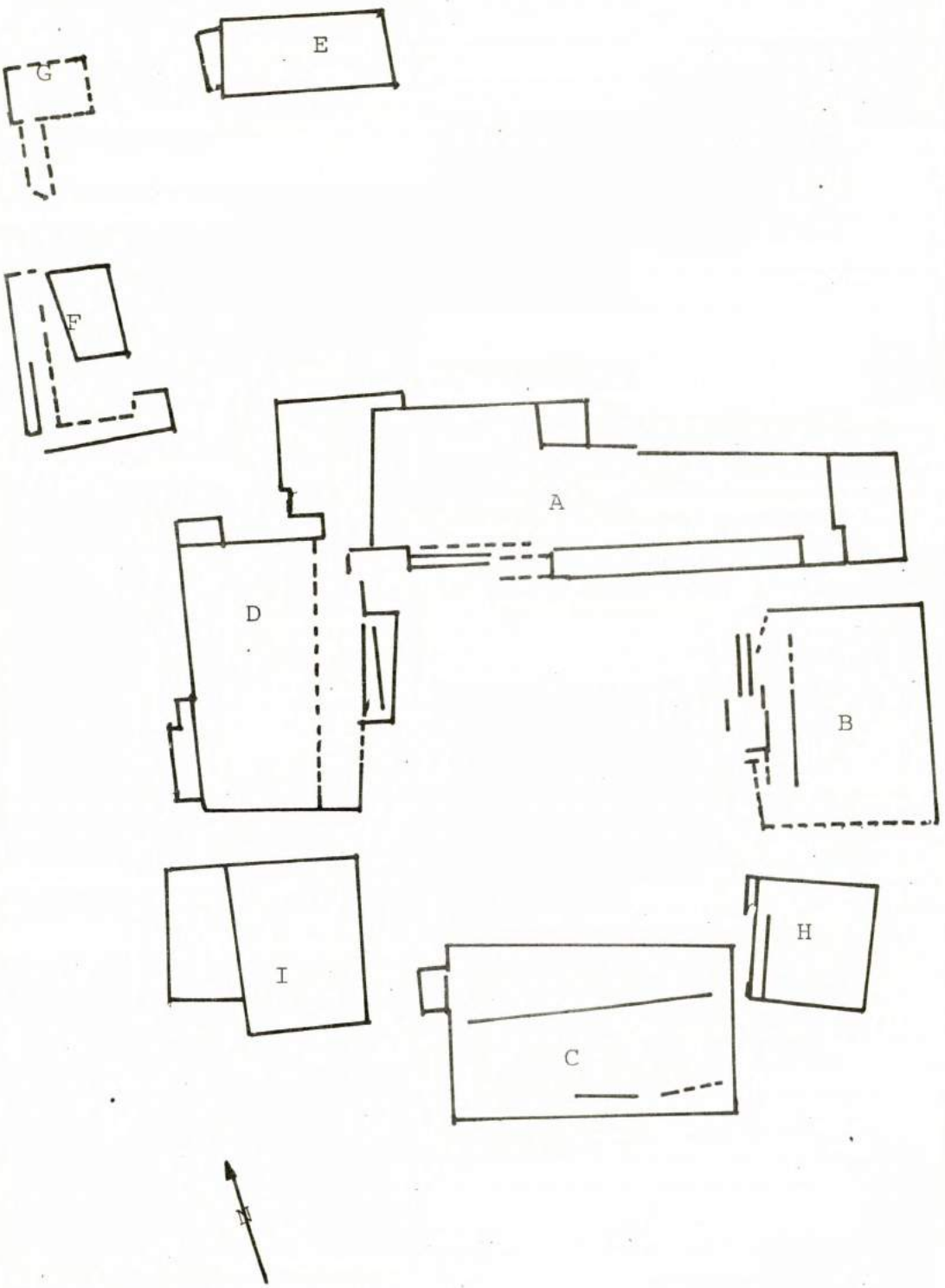

Figure 32: Map of Site CV 20

TABLE 69

Quantities of Polychrome Sherds Recovered
During Clearing Operations of Structures, CV 20

Structure Identification	Copador	Gualpopa	Babilonia
	N=1180	N=35[a]	N=89
A	33.6%	25.7%	51.7%
B	28.1	11.4	32.6
C	15.7	2.9	9.0
D	4.0	8.6	-
E	1.3	-	-
F	2.5	8.6	3.4
G	.4	-	-
H	1.6	-	-
I	13.0	42.9	3.4

[a]The small sample size should be noted.

(The small quantity of Gualpopa does not lend itself to much analysis.)

3. Although Copador's distribution is widespread there is a concentration, as with Babilonia, in Structures A and B. Structure A has been identified as containing a range of dwelling units while Structure B, with the highest elevation at the site, is thought to have functioned as a temple or shrine.

4. Even though the Gualpopa sample is very small, there seems to have been a heavier representation of this type in Structure I, tentatively identified as a kitchen area.

CV-43. This Type 3 site is made up of a number of plaza units which are thought to have functioned as an extended family residential unit (Leventhal 1981:203). Figure 33 is a map of the site; Table 70 shows the percentage of sherds by type and structure (clearing operations). A number of observations can be made:

1. Copador still dominates in terms of quantity but the other two types are more widely distributed than at the smaller site.

2. At this site few polychromes were found in Structure A which had a religious/administrative function. (This contrasts with

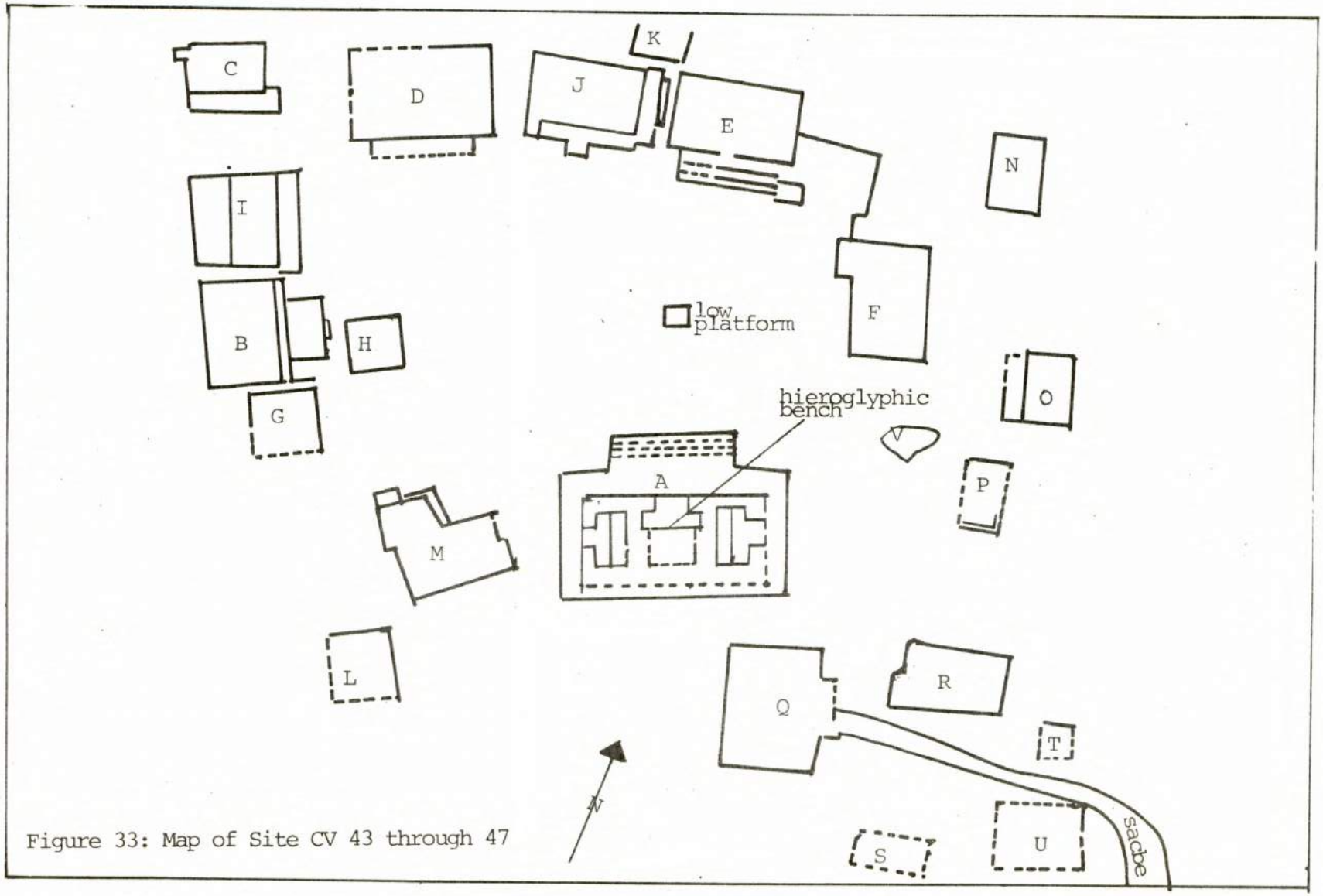

Figure 33: Map of Site CV 43 through 47

TABLE 70

Quantities Of Polychrome Sherds Recovered During Clearing Operations of Structures, CV-43 through 47

Structure Identification[a]	Copador	Gualpopa	Babilonia
	N=1343	N=146	N=285
A	3.0%	5.5%	1.8%
B	0.4	3.4	9.8
C	1.6	2.7	1.4
D	3.8	2.1	1.8
E	35.7	21.9	40.7
F	11.6	19.9	9.1
G	1.7	0.7	-
H	0.2	6.2	2.1
I	2.4	3.4	2.1
J	14.4	11.6	7.4
K	1.6	1.4	-
L	0.4	-	0.7
M	16.1	16.4	15.1
N	1.8	1.4	1.1
O	1.0	-	0.7
P	0.8	1.4	1.1
Q	0.1	0.7	-
R	0.8	0.7	2.8
T	1.0	-	1.4
V	1.6	0.7	1.1

[a]See Figure 37 for structure locations

CV-20 where significant amounts of Copador and Babilonia were found in Structure B, a temple or shrine.) Interestingly, a larger amount of all three polychromes than expected on the basis of building size was recovered from Structure M, adjacent to Structure A. The function of this structure has not been identified but its closeness to the dominant public building could imply an administrative use.

3. All three types are well represented in Structure E, said to be the residence of a head of family. Interestingly, a significant amount of Gualpopa (and lesser proportions of Copador and Babilonia) was recovered from Structure F, attached to Structure E and possibly representing a distinct domestic function.

This brief review of intra-site distributions of the three polychromes is not conclusive but it suggests areas for further investigation. There appears to be a difference between the two sizes of sites in availability of Gualpopa and Babilonia while Copador is prevalent at both sites. The by-structure concentration of types shows some similarities (Copador and Babilonia seem to co-vary in many instances) as well as some differences (Gualpopá seems different from the other two types but the frequencies are very small for CV-20.) When the ceramic data are analyzed in conjunction with other materials from the structures as is planned (Leventhal, personal communication, 1983) an interesting picture of structure function and site organization should emerge.

Distribution Pattern Within the Zapotitan Valley

Methodology

Field records from the stratified random sample survey of the Zapotitan Valley were studied and a tabulation made of the recorded presence of Copador, Gualpopa, and Arambala, as well as a local bichrome and polychrome of the Late Classic period. (See Appendix B for Chilama and Sacayil descriptions.) Chilanga was not found in the Zapotitan region, probably reflecting an Early Classic occupational hiatus following the Ilopango volcanic eruption.

The data used were from surface surveys of sites located through a random sampling strategy. Once a site was located in a selected quadrat, it was mapped and collected in a systematic, predetermined method. then surface collection was continued in a nonrandom method to ensure that all "diagnostic" materials were

saved. Since data from both types of surface collection were used in this analysis, it seems prudent to discuss the findings only in presence/absence terms.

Sites located by the survey were classified into a seven-part typology and were located according to several topographical strata (Black 1978). Both of these considerations will be used in analyzing the data.

Findings

Slightly more than one-third of the Late Classic sites surveyed in the Zapotitan Valley had one or more of the regionally distributed painted types. an additional 30 percent had painted types assumed to be of local (within the general Valley area) manufacture. In combination, then, 67 percent of these sites were using some type of painted ceramics (Table 71).

TABLE 71

Types of Ceramics at Late Classic Zapotitan Valley Survey Sites

Ceramic Type	Sites Surveyed	
	N	%
Copador, Gualpopa or Arambala, also possibly local painted type	16	37.2
Local painted types only	13	20.2
No painted fine-ware types	14	32.6
Total sites surveyed	34	100.0

In the Copan Valley, 79 percent of the sub-operations produced painted wares. Considering sampling error and other sources of variability, these proportions seem quite similar, indicating the general availability of painted and decorated pottery to Late Classic populations.(This factor has been commented on before by researchers working in other parts of the Maya lowlands: Belize [Willey et al. 1965:350-1,571] and Tikal [Culbert 1974:65].)

Further, the availability of either local or imported painted ceramics did not appear to depend on the physical location or size of the community in which a household resided. Table 72 shows ceramic distribution by topographic area within the Valley.

Basin sites would have had somewhat greater accessibility to San Andres, a primary regional center located in the Basin zone, yet the proportion of sites

with imported polychromes is no more than would have been expected.

Table 72

Distribution of Late Classic Ceramics in The Zapotitan Valley By Geographic Location

Geographic Location	Imported Polychromes	Local Painted Ceramics	No Painted Ceramics	Total
Basin	6	6	5	17
Western mountains	10	6	9	25
Southern mountains	-	1	-	1
Total	16	13	14	43

The ceramic distribution was examined using Black's site classification scheme. Because of the small number of sites in the sample, it was decided to collapse the seven-part typology into three classifications: isolated ritual precinct, hamlet/village, and large village with ritual construction/secondary and primary regional center. As shown in Table 73 there is little variation from that expected on the basis of the number of sites in each classification. There appears to be a tendency for painted ceramics to be more frequently associated with the larger centers, but a X^2 test of the distribution showed the probability of relationship to be around 0.5.

TABLE 73

Distribution of Late Classic Ceramics in The Zapotitan Valley by Site Classification

Site Classification	Imported Polychrome	Local Painted Ceramics	No Painted Ceramics	Total
Isolated ritual precinct	1	-	2	3
Hamlet/village	11	11	11	33
Large village with ritual construction/secondary and primary centers	4	2	1	7
Total	16	13	14	43

Finally, the distribution of the three types of imported painted ceramics was assessed (Table 74). Several interesting results emerged:

TABLE 74

Distribution of Imported Late Classic Ceramics in the Zapotitan Valley By Type

Imported Ceramics	Sites With Imports (N=16)	
	N	%
Copador	10	62.5
Gualpopa	5	31.1
Arambala	8	50.0

1. Copador was the most frequently encountered imported painted type, resembling the situation prevailing in the Copan Valley. (The small size of the site sample should be considered, however.)

2. Also similar to the findings from the Copan Valley, the regionally distributed polychromes were not restricted to larger, more complex sites. (See Table 75.)

TABLE 75

Distribution of Imported Late Classic Ceramics in The Zapotitan Valley By Type and Site Classification

Site Classification	Imported Ceramics			
	Copador	Gualpopa	Arambala	Total
Isolated ritual precinct	1	-	-	1
Hamlet/village	6	3	4	11
Large village with ritual construction/ primary and secondary center	3	2	4	4
Total	10	5	8	16

Use in Funerary Context at Copan[18]

Methodology

Longyear's volume, Copan Ceramics: A Study of Southeastern Pottery, (1952) contains a section with detailed descriptions of graves and tombs. Using his data, tabulations were made of the contents, location of the burial, position and characteristics of the buried person, and nature of the grave or tomb. The objective of this analysis was to determine if there was a relationship between the presence of Copador and other features that could be status ranked. Data were available for 19 Late Classic graves (no tomb construction) and 13 Late Classic tombs with construction. The two types of burials are treated separatly in the following section.

Before presenting the finds, however, it should be mentioned that there probably had been some degree of selection in terms of the subjects for these burials since most of the locations were within the center of the site or relatively nearby. It is to be expected that burial in the heart of the area with the most impressive architecture would be restricted to higher status individuals.
Thus, this is not a "random" sample of burials from throughout the Valley. While the data have been organized and will be reviewed from the perspective of social ranking differences, it is posible that variation in amount and content of burial goods reflects different considerations.

Findings

Graves. Burials were categorized according to whether or not the grave had received some preparation before interment -- preparation being equated with energy expenditure which would reflect esteem or power. Then it was found that four graves without evidence of preparation contained individuals whose teeth had been filed and/or inlaid: a mark of rank in Late Classic Maya society. Thus, three groups of graves were derived: 1) with preparation; 2) without preparation but occupant had inlaid/ filed teeth; 3) without

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[18]The same type of analysis had been planned for Tazumal, the Late Classic sector of the Chalchuapa zone. However, since complete descriptions of those graves and tombs have never been published it was not possible to do so. It would have been interesting to contrast the findings from the exporting area, Copan, and the importing area, Chalchuapa, to determine if a different social value had been ascribed to the ceramics.

preparation. Table 76 lists the graves grouped according to the preparation criterion. (Longyear's number is used for identification purposes.)

It can be seen that, while Copador is present in the prepared graves (assumed to represent a higher social rank than the graves without preparation), it also is included in half the unprepared graves. Thus, at least within these burial locations, Copador is not restricted to higher status graves.

Tombs. Burials were categorized according to an index of construction complexity which was derived in the following way. From Longyear's description it was possible to determine the number of chambers, the square footage enclosed, the use of a corbel vault, the use of cut masonry, the presence and number of niches, and the use of a cut slab floor or roof. These characteristics were considered evidence of the investment of skill and effort in preparing the burial place. The greater the ability to channel resources for burial investments, the higher the overall status should be. (Chapman and Randsborg [1981:9] review approaches that have been used to analyze ranking in mortuary remains. One of these is the "effort-expenditure principle" which includes assessment of the location and construction of the burial container. See also Tainter 1978.) Appendix G gives the details used in computing the construction complexity index.

The validity of such an index has not been determined since it has only been applied to this set of data.[19] It should be applied to tombs for which the status of buried individuals has been independently determined. Then the extent to which the derived index predicts the relative status can be used to assess the concept's usefulness. In the absence of such validation, other aspects of the burial circumstances were examined to determine if they supported the index ranking.

The measure seemed to be a general indicator of the quantity of grave goods, one frequently used indicator of status. With one exception, tombs indexed 5 and above contained more objects than did lower indexed tombs. Also, tombs with higher indices were more likely to have a variety of materials rather than just pottery. Thus, the "richness" of furnishings seems generally related to construction complexity, which would

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[19]Brown (1981:29) cites a methodological weakness in effort-expenditure measures since it is difficult to assess differences in procurement costs of different materials, etc. Giving equal weight to the presence of a niche or a corbel vault may inadequately represent actual effort-expenditure in my scheme.

TABLE 76

Details of 19 Copan Graves By Preparation Classification

Preparation	Total pottery pieces	Other burial goods[a]	Location[b]	Comments
Some				
19 (2 skeletons; one child)	5	1,5	1	Copador melon Gualpopa
1-42	3	1,8	1	2 Copador
24 (child)	1	0	1	Ulua-Yojoa
None but filling/inlay				
3-42	2	0	1	Gualpopa
4-39	2	0	1	
3-39	0	0	1	
25 and 26	1	10	1	Ulua-Yojoa
None				
26-42 (child)	2	0	2	Copador
1-38 (child)	3	0	1	Ulua-Yojoa
1-39 (child)	1	0	2	Gualpopa
4-46 (tight flex)	0	0	1	
7-42 (flex right)	1	0	1	
28 (flex right)	5	1,6	1	2 Chilanga, 2 Gualpopa
34 and 35 (34-adult flex left; 35-child)	1	0	1	Copador
31 (flex on back)	2	1	1	Chilanga(?), Gualpopa(?)
1-43 (Don't know)	1	0	1	Copador
1-40 (Don't know)	1	0	1	Copador
3-38 (Don't know)	1	0	6	Copador
20 (Don't know)	2	5	1	Copador and Chilanga(?)

a) Types of burial goods other than ceramic vessels: 1) jade bead(s)/ pendant/worked jade; 2) mirror fragment; 3) unworked jade/shell/obsidian/bone; 4) incised peccary skulls; 5)deer bone, turtle shell; 6) pottery whistles/ cylinder stamp/spindle whorl; 7) pearls and fish bones; 8) earplugs; 9) spondylus shell and other miscellaneous; 10) silicified charcoal.

b) Location: 1) "Cemetery area"/Acropolis/main plaza; 2) Landing field (slightly west of the main center); 3) foothills (Group 5); 4) west of main group, between main group and town (Group 8); 5) east of main group; 6) southwest of main group.

lend support to construction complexity being a status related variable. Within this context of hypothesized status-relationship, the tombs are listed in Table 77 in ascending index order.

TABLE 77

Details of 13 Copan Tombs By Index Of Construction Complexity

Index Value	Total pottery pieces	Other burial goods[a]	Location[b]	Comments
$\frac{3}{27-42}$	2	0	2	jade inlays
17-42	0	1	5	
1-38	1	1,2	1	
$\frac{3.5}{1-46}$	4	0	1	3 Copador
$\frac{4}{18-42}$	2	1	1	2 Copador
$\frac{5}{1}$	11	3-6	1	Gualpopa, probable
2-38	1	8	1	Chilanga; jade
2-46	0		1	inlays and filing
$\frac{6}{11}$	11	3,7	3	Ulua-Yojoa
1-42	2	3	1	Copador jar
3	3	3,9	1	Gualpopa
$\frac{7}{4}$	4	1,3,8	4	
$\frac{8}{2}$	4	3	1	Quetzal vase, possible Peten polychrome, tentative Copador

a) See legend on Table 76.
b) See legend on Table 76.

The choice of Copador as a grave good does not seem to vary directly with construction complexity. The ceramic is present in the highest indexed tomb as well as in one at the next to lowest rank. Dividing the tombs into two groups -- those with an index less than 5 and those indexed as 5 and over -- results in two tombs with Copador in each subdivision. It is interesting to note that the two tombs with more than one piece of Copador are in the lower indexed group. It would almost seem as if "conspicuous consumption" were occurring in these instances.

Given the limitations of the data and the method, the main statement that can be made is that Copador is not clearly associated with the more complexly constructed tombs. Just as it was found in the unprepared graves as well as the prepared ones, it occurs sporadically in various types of tombs. Its role as a status related funerary good, therefore, is equivocal.

Conclusions

In both the Zapotitan Valley and the Copan Valley painted ceramics were widely available during the Late Classic period. The pattern of distribution in both areas indicates that the types of serving vessels under investigation were not restricted to high ranked households. Furthermore, Copador was the most widely available painted serving vessel in both valleys. While data are incomplete, it seems that not only did Copador have the most widespread distribution in Copan Valley but circulated in the largest quantities. Both findings point to 1) the size of production capacity and 2) a product that is not status restricted.

Somewhat in contrast is the situation with Gualpopa. It was less widely distributed and showed some restrictions in the Copan Valley to larger residential units -- more of a correlation with status.

These patterns suggest a possible functional difference between the two polychromes. Within this research the differences cannot be tested but speculation suggests that the widespread occurrence of Copador relates to a role it played in household-level ritual. Perhaps the ceramic was the appropriate one to use for offerings at a household shrine or in some other way functioned in a religious context that cross-cut status lines. Gualpopa, on the other hand, may represent purely domestic use -- hence its tendency to be more available to higher status households.

The prevalence of Babilonia in the Copan Valley was an unexpected finding. It appears that these ceramics from central Honduras were quite successful in

competing with the locally made Gualpopa. This contrasts with the situation at Los Naranjos in the Babilonia producing area where Gualpopa was not encountered at all and only a handful of Copador was recovered.

Copador's tenuous place as a high status product is brought into greater question from a review of its funerary context use at Copan. Admittedly, the scope of this analysis is quite limited but the indications are that Copador was not restricted to higher ranked burials; its use cross-cut the classification of graves and tombs developed.

CHAPTER 7

CONCLUSIONS

PRODUCTION

In Chapter 1 a number of hypotheses were set forth relating to the production of Copador serving vessels. The research findings will now be discussed from the viewpoint of these hypotheses and the specified tests.

Hypothesis I: Production occurred in a restricted geographic area with clay from a similarly restricted procurement zone. This hypothesis was tested by studying the trace elemental composition of samples of Copador from various proveniences; other cream paste ceramics from the same proveniences were tested for comparison purposes. Arambala red-paste ceramics were evaluated from the same hypothetical viewpoint.

Chemical characterization analysis supported the hypothesis. The conclusion was that a majority of the Copador vessels were manufactured in one zone but from two separate clay resources. The fact that all the Copador serving vessels were not made of raw materials from a restricted procurement zone means that the production system was not a tightly controlled one. The variability in the paste composition of the vessels not made in the centralized zone indicates production by a number of potters relying on different clay deposits, further emphasizing a lack of restriction on who could manufacture vessels of this type.

Comparison types. Gualpopa: A similar pattern was found as with Copador. The bulk of the production was centralized in one zone but was not tightly restricted to that area. Vessels from other raw material sources were found at the various distribution points. Chilanga: This cream ware began earlier than Copador or Gualpopa. (It persists in western Honduras through the Late Classic but seemingly terminates in the Early Classic in western and west-central El Salvador.) Chemical compositional data indicate that much less of this ceramic was produced in one central zone; more of it appears to be the product of stylistic exchange. Chilanga has been associated on the basis of motifs with Gualpopa and Copador (Longyear 1952:30). From a production standpoint it could have been an antecedent whose modest level of centralized production and trade expanded into a growing market for the more highly

decorated polychromes, Gualpopa and Copador. Arambala: Chemical characterization of this red paste type was less thoroughly investigated than that of the cream paste types. Nevertheless, limited analysis suggests the use of resources from a restricted zone of western El Salvador. Chalchuapa is a possible production locus but additional study would be necessary to verify or negate this hypothesis.

Hypothesis IA: Copador was produced in the Copan Valley. This hypothesis was tested by comparing the trace elemental composition of the Copador clays judged to have been procured from a restricted resource zone against the composition of clays used in locally made Copan Valley ceramics. This hypothesis was not supported from the trace elemental compositional data. Statistically significant chemical differences were found between the cream paste ceramics and local pottery from the various sites in the study -- Copan, Chalchuapa, Quirigua, and the Zapotitan Valley.

X-ray diffraction of local domestic pottery from the Copan Valley revealed the presence of montmorillonite and mixed layer montmorillonite-illite minerals. Scans of Copador and Gualpopa pottery did not show equivalent mineral peaks. This finding, in combination with low iron concentrations in the cream-paste types, suggests that a different type of clay, probably kaolinite, was the basic raw material for Copador and associated ceramics.

Even though the hypothesis of a Copan Valley production locus was not supported by the chemical compositional work, it was not discarded for two reasons: 1) The percentage of Copan provenience pottery in the Copanfocus compositional reference group argues for Copan Valley production on the basis of a "Criterion of Abundance" (Bishop, Rands, and Holley 1982). 2) Clay deposits in the Copan Valley as preliminarily described (Turner et al., n.d.) appear to be diverse, resulting from different geological histories. Consequently, the geological possibility of Copador clay sources in the Valley is realistic. The accuracy of this hypothesis needs to be verified through analysis of white-firing clays from the Copan Valley; until such a project can be carried out, no firm conclusion can be stated.

Hypothesis II: The conversion of the clay to finished vessels was done by craft specialists working within a production system geared to standardization and simplification. This hypothesis was tested through quantitative analyses of various aspects of the vessels' shapes and decoration. The other painted types were evaluated through the same analyses to provide a comparative frame of reference.

Copador bowls -- both open and recurved shapes -- were quite standardized and simplified in terms of their dimensions, organization of the design fields, and selection of materials for decoration. These characteristics substantiated the initial assumption that the ceramics were produced by occupational specialists.

The degree of variability in the painted decoration -- the combination of motifs, the use of set paint colors in various areas of the vessel, etc. -- was greater than would have been expected if the ceramics had been made in large workshops. Within large workshops, the decoration step in ceramic production would likely be very formularized with vessels painted to duplicate a model or standard. Copador bowls show some clustering of decorative variables but not at a strong enough level of association to indicate large workshop organization. It appears more likely that these serving vessels were produced in smaller production units, probably family level workshops, conforming to established modes of decoration but exercising individual preferences for specific executional and motif features. In other words, there was no strong central control over the decorative aspect of their manufacturing.

One interesting pattern carries implications for the organization of the decorative process, functional requirements for the bowls, or both. Quantitative analyses determined that the interior decoration was more standardized than either the exterior decoration or the interior and exterior combined. Furthermore, the interiors used less complicated motifs. These observations can be interpreted as having resulted from different craftsmen painting the two vessel surfaces -- the less experienced being assigned the interior and working to a pattern, the more experienced doing the exterior and being allowed more freedom of expression. The same painter could have done both surfaces, of course, just allocating more time and effort to the more important exterior surface. Another interpretation is that the vessels' function required certain interior designs while decorative flexibility of the exterior was allowed. There is no way to know if any of these interpretations are valid but they are intriguing possibilities to consider.

The various characteristics of Copador vases -- dimensions, organization of the design field, variability in decoration -- did not fit the hypothesis of production geared to standardization and simplification. Rather, these pieces showed evidence of elaboration that would be more characteristic of specialized production for elite exchange. In line with this was the craftsmanship evaluation made by the investigator. More of the vases were judged to be of better craftsmanship than were the bowls. It cannot be stated

whether the Copador vases were painted by the same craftsmen who decorated the bowls. Whether they were or not, the end products reflect a more individualized approach to the designs and greater care in execution -- both indicating a larger investment in time and energy. It is interesting to note that Copador vases seem more prevalent within the Copan Valley than at other proveniences. The shape is relatively infrequent at Chapchuapa (45 cases out of a total count of 805 Copador pieces), and no whole vessels from El Salvador were located. This distributional situation may further attest to the different role of vases and bowls.

Gualpopa open bowls, like Copador bowls, were determined to be the result of occupational specialization on the basis of their simplification and standardization (dimensions, organization of design field, selection of materials for decoration). Even less standardization of decoration was observed than among the Copador bowls, however. Thus, it would appear that these ceramics were made by a number of independent production units applying very general stylistic canons. One subgroup of Gualpopa open bowls, decorated in a spiral fashion wherein the entire exterior, including the convex base, was treated as a continuous design field, may be an exception to this conclusion, but the small size of the sample precludes any definitive statement.

Gualpopa vases did not exhibit characteristics of standardization or simplification. In contrast with Copador vases, however, the Gualpopa specimens did not show any elaboration of design or paint colors. The choice of designs and their execution were much the same as for open bowls. Consequently, it seems likely that the Gualpopa bowls and vases were made by the same craftsmen in small scale decentralized production units.

Whether Chilanga open bowls were made by full time specialists is questionable. Dimensions and organization of the design field are less standardized than for Copador or Gualpopa bowls. The bowls certainly are simplified in these respects as well as with regard to paints and slips. However, this simplification alone is not considered sufficient to classify the product as resulting from specialization. In terms of decoration, design motifs not only are extremely varied but in most instances so simple that it is difficult to make a case for expertise in painting. The use of the negative Usulutan technique on the interior of the vessels does argue for shared technological knowledge and skill in achieving the batik-like effect.

Data from the quantitative analyses of Arambala can be interpreted in one of two ways: either as evidence for a production system based on standardization

and simplification or as evidence of stylistic borrowing without production system implication.

Dimensions, organization of the design field, and selection of materials for decoration all qualify Arambala as a product of simplification and standardization. Similarly, the decoration related variables show equally strong or stronger associations as does the set for Copador recurved bowls. All these findings are compatible with the hypothesis regarding the nature of the production system.

However, other less tangible data must be considered. Arambala has long been thought of as a derivative of Copador; in fact, it was informally termed "imitation" or "false" Copador by earlier researchers (Longyear 1952; see also the discussion by Sharer 1978a Vol 3:57-58). Cluster analysis during this project verified that one main group of Arambala bowls duplicated the motif combinations of one of the Copador recurved bowl clusters. Thus, the possibility exists that characteristics of Arambala resulted from copying one decorative variety of Copador known from exchange goods. This stylistic borrowing still could have taken place within the type of production system posited for Copador. Unfortunately, the limited chemical compositional analysis of Arambala paste does not provide clear-cut evidence for restricted resource utilization. Consequently, no direct conclusion will be drawn regarding the type of system producing Arambala serving vessels.

Hypothesis III. The size of the production system -- the number of production units and the amount of ceramics made -- relates to a complex exchange system, either redistribution or marketing. The expectations set forth in Chapter 1 for a complex exchange system included a moderate number of production units but of a type that could manufacture a large quantity of ceramics, probably centralized workshops. Other expectations for exchange systems of this complexity were that there would be a high degree of standardization and simplification.

From the standardization data discussed previously, Copador bowls do not seem to fit these expectations. Simplification is evident and some extent of standardization is present but not what would be considered attainable in centralized workshop facilities. Rather, it was concluded that these ceramics represent the output of small workshops, probably organized at a household level.

When attention is turned to the amount of ceramics made, however, the quantity of Copador is extensive. In terms of regional distribution, approximately

40 percent of the Late Classic sites recorded had Copador ceramics. Within the Copan Valley, about two-thirds of the sampled Late Classic sites sampled included Copador in their ceramic inventory; within the Zapotitan Valley of El Salvador, 25 percent of the sites surveyed had Copador. At Chalchuapa Copador represented 0.9 percent of the total ceramic sample for the entire occupational sequence (Sharer 1978a Vol 3:111), not an insignificant amount. Its replacement rate must have been considerable since it was taken out of circulation through use in caches and burials, as well as subjected to breakage from standard domestic use. The conclusion from these data is that the scale of production was large.

If this conclusion is accurate, then a large number of household level workshops would have been needed to amass the quantity necessary for exchange. This type of production organization seems at variance with the expectations for complex exchange systems. However, two possible incentives for decentralized production should be considered:

1. If white-firing clay is available in isolated pockets within the valley, it could have been more cost effective to produce near these smaller scaled resources rather than to pool resources for larger scaled centralized production. (It is also possible that the whitefiring clay resources were considered household or lineage property and their use was restricted to group members. This would encourage decentralized production as well.)

2. David Freidel (1981) has postulated that decentralized production among the lowland Maya was part of a socio-political structure of dispersed residence which had as its goal "the control of movement between places where activities are performed" (ibid:382). He postulates that management of the economy focused on control of distribution which was accomplished through a system involving elements of fairs and pilgrimages. His model is set forth in very general terms but the idea is intriguing and if correct could have precluded the development of larger, centralized production units.

Summary

The three cream paste ceramic groups can be viewed as overlapping points in a gradually changing pattern of pottery production within the Copan Valley.

The following reconstruction is based upon a combination of data from the various analyses already reported, as well as qualitative impressions reached during the course of this research. As such, it is somewhat conjectural and is presented as a generalized overview.

The bichrome, Chilanga, was produced by part-time specialists with access to two main clay resources. Serving vessels made by these potters were distributed within the Copan Valley and exported from there. Other potters who were not tied in to the Copan export exchange system also created Chilanga vessels for local distribution. As time went on, export from Copan ceased but production in Western Honduras continued among both sets of potters.

The polychrome, Gualpopa, is added to the Chilanga "product line" as an extension: the same shape is dominant, the spatial orientation is maintained, black paint is added and designs become more complex. There is more emphasis on the control of distribution -- less of the total production is accounted for by the small scale producer. The potters have become full-time specialists by now, tending to more standardization of shapes, but still working in small production units, exhibiting variability in their decoration of the ceramics.

Slightly later in time, production of Copador is begun. It is believed that Copador was consciously introduced as a type of ceramic to be made for widespread distribution, including export. This belief is based on the fact that Copador breaks with the Chilanga-Gualpopa tradition in several ways:

1. A dominant new shape was added: recurved bowls.

2. A different red pigment was exploited: specular hematite.

3. Interior decoration was added to the old preferred open bowl shape.

These innovations are interpreted as being intentionally created to establish the uniqueness of the new type of ceramics and thereby create a market for it. (As mentioned in Chapter 6, a religious function may also have been developed for the ceramics which helped ensure their widespread circulation and use.)

It appears, however, that the production system was not radically changed but rather was overlaid on the existing one: the pattern of resource utilization was comparable; production units were still decentralized; some small scale producers not tied into a centralized distribution system still persisted.

It is believed that changes may have taken place within the dispersed production units which enabled them to achieve a larger output: different specialists responsible for shaping and decorating; different painters responsible for decorating the interior and exterior of the vessel. Nevertheless, there does not appear to have been a switch to large centralized workshops: paste and design variability are too evident.

Distribution, then, would appear to be the part of the process that was reorganized to accommodate the movement of greater quantities of goods. Glimpses of export influenced decisions can be seen in the decoration of Copador recurved bowls where the export product was more standardized and favored different motifs than did the locally distributed articles as well as in a selection by size for the exported vessels.

DISTRIBUTION AND CONSUMPTION

Distribution

Size and directionality were the two aspects of overall distribution analyzed. As mentioned in the preceding section, the number of sites at which Copador has been recorded as other than an isolated find is substantial. The quantity of Copador recovered during the recent work in the Copan Valley as well as at Chalchuapa and Zapotitan Valley sites reinforces the conclusion that a sizable quantity of serving vessels moved in the distribution system. It is interesting to note that recurved bowls which would not "nest" as well for transport as open bowls were nevertheless frequently found in non-Copan proveniences. (See Table 21.) Thus, an implication could be that Copador did not travel to its consumers in large wholesale-like quantities. Unfortunately with the current data base, it is not possible to investigate the mechanisms which might have been used in the distribution of Copador ceramics.

The directionality of distribution was clearly to the south and southwest from Copan. Within a 50 km radius of Copan it would appear that Copador was widely available. Beyond that distance, however, distribution became sharply channeled toward settlements in western and central El Salvador. Stanley Boggs has stated (personal communication, 1981) that he knows of no Late Classic site west of San Salvador without Copador. The distributional pattern bears out his assessment. Two other areas seem to have participated in the Copador distribution system: 1)the Middle Motagua near San Agustin Acasguastlan and 2) the mountainous Guatemalan -Honduran border area.

It is interesting to speculate about commodities that could have been exchanged for Copador serving vessels in the various distribution sectors. While

probably more than one item was traded per area, some obvious candidates can be mentioned:

1. El Salvador: cacao, balsam, indigo. Browning (1971) discusses the agricultural products cultivated in El Salvador during the early post-Conquest period and their pre-Conquest antecedents. Balsam, which is the sap of the hardwood tree balsamo, is prized for its medicinal and aromatic properties. The coastal area southwest of Izalco in western El Salvador is the only part of America where the tree grows. Early documents say that the Indians in the area had collected balsam before the arrival of the Spaniards (ibid:61). Cacao, which was an important trade item in Late Postclassic times, grew well on the southern slopes of the volcanic highlands along the Pacific Coast of Guatemala and El Salvador. Indigo, which the Spanish prized as a colorant, was cultivated in post-Conquest times in the coastal districts of Escuintla (Guatemala) through El Salvador to the lowland areas of western Nicaragua. Browning states that the pre-Conquest inhabitants probably also knew of its properties and cultivated the plant (ibid:66).

2. Middle Motagua: jade. As mentioned previously, work in the San Agustin Acasaguastlan zone has uncovered a number of jade outcroppings as well as areas interpreted as being jade workshops.

3. Guatemalan-Honduran border: obsidian from Ixtepeque.

The areas that did not participate in the Copador distribution system would seem to have offered alternative sources for some of these commodities, such as jade from the Quirigua and lower Motagua areas, but not unique resources unattainable elsewhere. A thorough investigation of the exchange network in the southeastern Maya periphery cannot be attempted at this time. Many unknowns remain. For example, while central Honduras did not participate in the Copador distribution area, there seems to have been regular exchange between that area and Copan to judge from the amount of Babilonia polychrome in the Copan Valley.

Consumption

Copador was a widely available ceramic product used by people at all levels of Maya society, as judged by the contexts in which it has been recovered. Within

the Copan Valley its distribution was less restricted than that of other coeval painted types. It is possible that some of the Copador available in the Copan Valley represents "seconds" that were not acceptable for exchange products and so were consumed locally. Since sherd lots from all Valley proveniences were not accessible, this possibility could not be evaluated by a direct examination of materials.

Another possibility set forth in the preceding chapter is that there was a functional difference between Copador and Gualpopa or Babilonia. That is, Copador could have functioned in connection with household level ritual or religion which cross-cut status lines, a use that ensured its widespread presence in households. Gualpopa and the imported Babilonia, on the other hand, could have functioned as straightforward domestic items, resulting in a more restricted distribution that was more highly correlated with status.

In keeping with the increasing data which seem to position Copador as a "middle class" item rather than a "primitive valuable," an analysis was made of the burial contexts in which it was found at Copan. Based on a loosely established assessment of relative status, the conclusion is that Copador was not restricted to higher status burials.

Summary

The amount of Copador distributed speaks for a well-organized distribution system. The distance over which the ceramic moved is evidence of the economic influence of the distribution center. The direction in which the distribution was focused speaks of the other links or nodes in the trading network and provides clues as to the probable kinds of other commodities moving in the exchange system.

The fact that Copador was not restricted to the elite indicates that the economy was complex enough to support independent specialists who were not attached to an elite producing only luxury items for restricted consumption.

REVELANCE OF THIS RESEARCH TO CURRENT CONCERNS IN MAYA ARCHAEOLOGY

Current Maya research reflects the overall interest of the profession in the theme of social process, of reconstructing the political, social, and economic organization of the society in its various epochs and over its geographic range. Henderson (1981:234) stated that "not one facet of Maya civilization is fully understood... even basic aspects of Maya civilization are puzzling." Consequently, it is not

surprising to find a diverse set of research topics in the forefront of Maya archaeology: subsistence systems, trade networks, settlement patterns, symbolic systems, political structure.

From these various viewpoints, however, researchers are attempting to fit together pieces that will result in the "fullest possible reconstruction of Maya culture history, region by region, [as] the essential framework for an understanding of the development of the Maya cultural tradition. Explanation -- identifying and characterizing processes of culture change -- is inseparable from historical reconstruction. Process is history" (Henderson 1981:236, emphasis in original).

This study focused on production, distribution, and consumption of painted ceramic serving vessels in the southeastern periphery of the Maya area during the Late Classic period. Its intent was to elucidate part of the economic strategy that had been in operation, thereby contributing to the reconstruction of the broader Maya culture history.

The investigation disclosed that production of polychrome serving bowls (Copador and Gualpopa) had been carried out by craft specialists working in decentralized circumstances, probably household or small community workshops dispersed around the main center. A central authority did not heavily control or influence ceramic production in the southeastern area. This agrees with a similar conclusion reached by Fry (1981:154) for the general southern lowlands and based on data from Palenque and Tikal. He contrasts this situation with that found by Feinman in the Valley of Oaxaca where the Monte Alban state did intervene in the pottery production system. "High administrative involvement in economic transactions was correlated with a highly centralized large scale ceramic production industry" (ibid).

The social status of the craft specialists involved in the serving vessel production was not a factor that could be evaluated within this research design. However, there are indications both from archaeology and ethnography that potters occupy areas of marginal resources and hold relatively low social positions as a class (Arnold 1975, 1978; Rands and Bishop 1980:22; Coggins 1975:429; Fry 1981:151).

Distribution of the polychrome serving bowls showed several outstanding characteristics: areally widespread, directionally skewed, not restricted to elite contexts. The widespread nature of the distribution indicates that significant mercantile activity took place in this part of Maya society during Late Classic times. The mechanism is not known but, if the

potters had generally low social status, it is likely that their wares were handled by an intermediary merchant who had the resources to organize trading expeditions. Whether there was a Maya merchant "class" as in later Triple Alliance times has been debated repeatedly. Functionally, it appears there would have been a similar role even if the social organization were less rigid.

The role of the elite in the distribution system is not clear. First of all it must be recognized that "elite" is a very general term connoting an unspecified type of status higher than "nonelite." This term is used because one of the unsettled major issues in Maya archaeology is the nature of the society's social structure. Even though major centers are associated with ruling dynasties or lineages, models for the overall organization of Maya settlements are still being discussed and debated.

Recent attention has been given to positioning Maya Classic society as a feudal-type socio-political structure (Adams and Smith 1981; Sanders 1981; Willey 1981). Characteristics of this type of structure are: diffused political power; authority, status, and wealth based upon ownership of agricultural lands; and a hereditary principle for the passing on of power and lands. The diffused authority and power is ranked and behavior of ranks is determined by codes of obligation. There are "horizontal" as well as "vertical" relationships; elites intermarry so as to maintain social stratification (Willey 1981:409). Adams and Smith (1981:346) believe that a feudal-type organization where the elite are dispersed throughout the region in centers would have the advantage of enabling a small sized elite to control a much larger population as compared with more centralized systems of political control. In this model the function of the centers was political; the lowland Maya center is not seen as an important trading or manufacturing place.

Willey, in his summary review of the settlement pattern symposium (1981:385-415), acknowledges that much in the feudal socio-political system fits the lowland Maya evidence. He see the limited role of trade in the model as being in sharp contrast with other views in which "the institution of trade was a dynamic factor in the growth of the Maya system" (ibid:414). He continues by saying:

> I think complex society in the lowlands was achieved without much ih the way of trade, at least on the early rungs of the sociopolitical ascent. Some trade undoubtedly took place from the very beginning, but I would

> guess the infusion of ideas was more important than the goods that went along with them at this time. Later trade and manufacturing were obviously important," (ibid).

The applicability of the feudal model to lowland Maya society may well turn out to be a better explanatory tool for earlier periods of the culture than for the Late Classic epoch. The importance of ceramic exchange in the southeastern periphery during the Late Classic seems hard to deny from the extensive pattern of serving vessel distribution. If it were not the concern of the "royal" central elite, provincial elite most probably participated in the trading activity.

The directional skew of serving vessel distribution to the area southwest of the Copan Valley reconfirms qualitative observations made by earlier researchers. It also highlights Copan's peripheral location vis a vis the main part of the Maya lowlands as well as a variation between its political and economic orientations.

From glyphic evidence it appears that there was a period of pronounced contact among major Maya centers between 672 and 751 A.D. (Marcus 1976). Based on the usage of emblem glyphs, Marcus proposed a four-level hierarchy of centers, including regional capitals. Copan appears to have participated in this political system during this period. Its emblem glyph appears with those of Tikal, Palenque, and Calakmul on Stela A at Copan, dated to 731 A.D., in a context that suggests regional capitals viewed as occupying the four quadrants of the Maya universe (ibid:17). The Copan emblem glyph also seems to be on carved bones found with Burial 116 beneath Temple 1 at Tikal (700 A.D.) (ibid: 150). Marcus' theory of regional capitals has been questioned by others but the pattern of occurrence of foreign emblem glyphs would indicate contact and participation in some form of inter-center association.

On this basis, Copan appears to have been an accepted member of the territorial organization interpolated from the epigraphy -- territory that centers to the north and west of Copan. Concurrent with this political or territorial orientation was an economic orientation in the opposite direction, away from the main Maya culture area toward the outlying areas of western El Salvador.

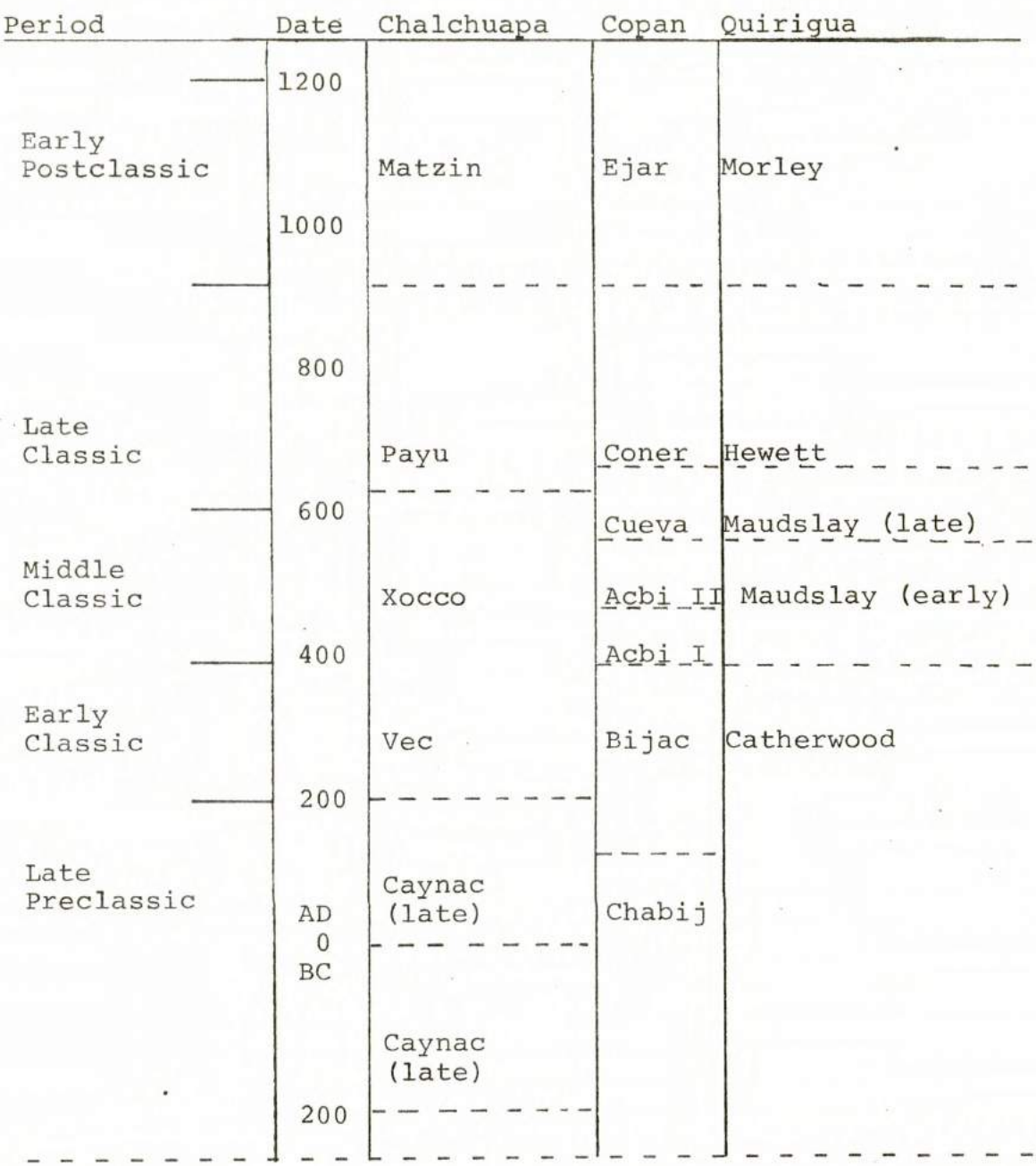
Interaction between these two subregions had been occurring since earlier times but it seems particularly notable and strong during the Late Classic when, in noneconomic ways, Copan was oriented away from El Salvador. The economic isolation of Copan from much

of the Motagua Valley, and by extension the Peten, has recently been attributed to an event occurring in 737 A.D. which seems to have been a defeat (military?) of Copan by Quirigua. Subsequent to this time Quirigua appears to have assumed greater dominance and perhaps precluded Copan from using whatever trade routes had been available to it in that direction (Jones and Sharer 1980). The nature of Copan's place in the political organization of the Late Classic Maya lowlands and the interface of political with economic systems needs to be better established before the observed pattern can be satisfactorily explained.

The consumption of Copador ceramics in a variety of social contexts raises questions about the ceramic's role in the symbolic system of the Maya. The dominant motif combinations, including the glyphic designs and the standardly attired human figures, possibly functioned as a means of achieving information exchange among dispersed social groups as a part of a process of social integration (Wobst 1977:327). Ceramics with these stylistic features could have been marketed as visible symbols of participation in the Maya tradition -- religion or a broader cultural identity -- which Copan would have exemplified to the importing areas. Ideological values likely operated as a sales tool in Copador's distribution and consumption.

APPENDIX A

COMPLEX NAMES AND EQUIVALENCES
COPAN, QUIRIGUA, CHALCHUAPA



Earlier sequences are not pertinent to this study. (Adapted from Willey et al.1980.)

APPENDIX B

DESCRIPTIONS OF PAINTED CERAMICS

Main Ceramic Groups Investigated

The terminology for the ceramic groups in this investigation is that used by Sharer in the Chalchuapa ceramic report (Sharer 1978a Vol. 3). This report was the first instance in which the type-variety system was applied in a standardized manner to these particular ceramic materials. An abbreviated format, patterned after the Chalchuapa presentation, will be followed here. Each description lists for the major site in each subregion the ceramic complex in which the group occurs. (See Appendix A for ceramic group names and their equivalences for the sequences at Copan, Quirigua, and Chalchuapa.) Next in the description are given the main identifying attributes which distinguish the group; the vessel forms in general order of frequency then follow. The final part of each description specifies the known distribution of the ceramic group along with a summary statement of the approximate magnitude of its occurrence, where known. Profiles of vessel forms used in the research are shown in Figure 38.

A more complete description of the pastes and surface finishes along with decorative details can be found in Sharer 1978a Vol 3.

Copador Polychrome

Ceramic Complexes: Copan - Coner
Quirigua - Hewett
Chalchuapa - Payu

Identifying attributes: 1) Specular hematite or deep purple-red, black and usually orange paint on a cream or orange tinted slipped background; 2) glyphic, human and bird, or geometric motifs; 3) fine cream to light buff paste, soft in texture.

Forms:
a) Convex-wall bowls with direct rim
b) Composite-wall bowls with direct or slightly everted rims
c) Faceted-flanged composite-wall bowls with direct rims
d) Vertical wall cylinders
e) Low (less than 10 cm) vertical wall cups
f) Small restricted-neck jars with direct rims.

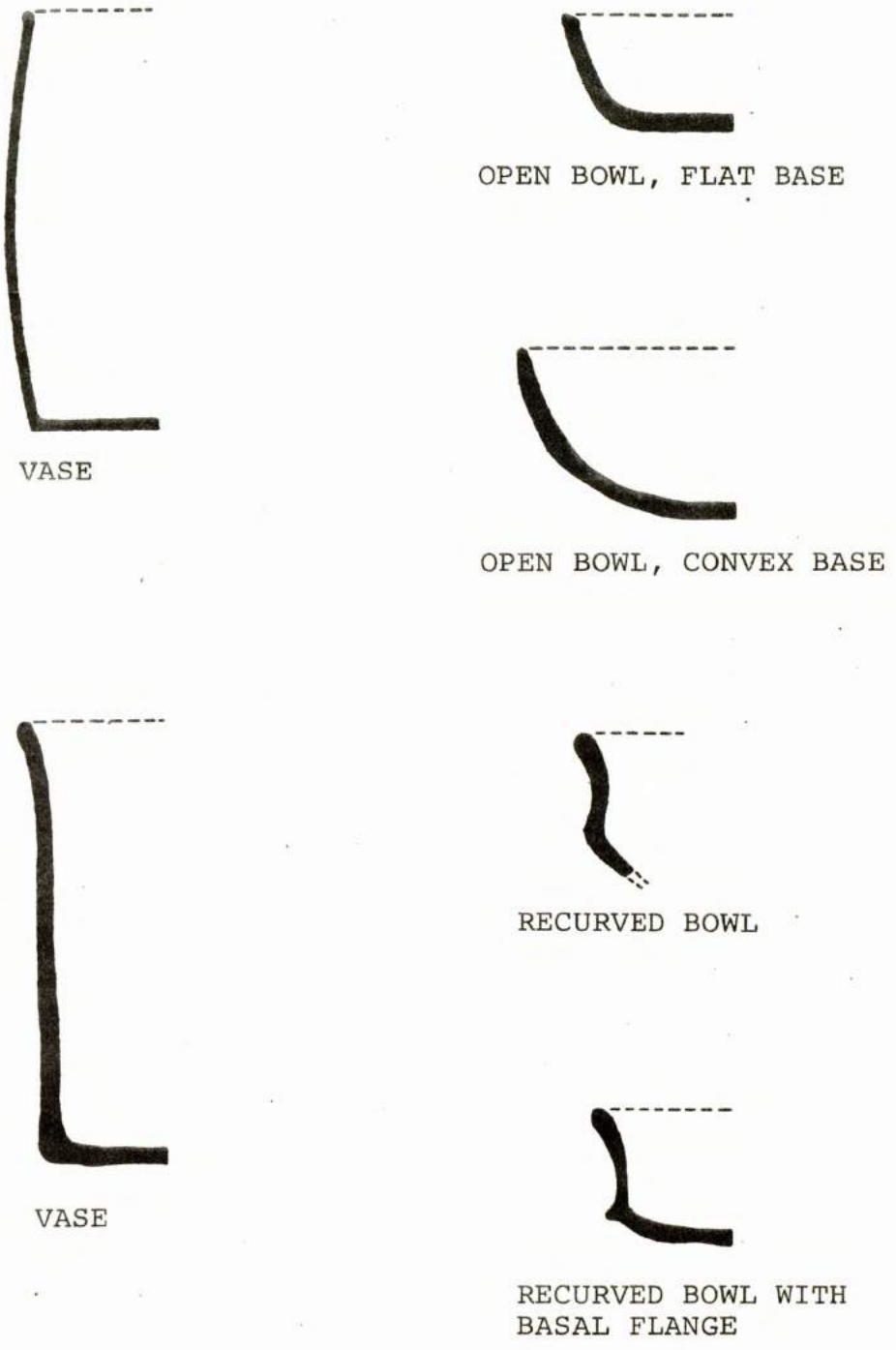


Figure 34: Profiles, Vessel Shaped Used in The Research

Distribution:

Copan - predominant Late Classic polychrome
Chalchuapa - predominant
Zapotitan - dominant
Quirigua - practically absent
Other observations (frequency not known):
Playitas (lower Motagua)
Guaytan (Middle Motagua)
Asuncion Mita (Guatemala-El Salvador border)
Tiquisate region (South Coast, Guatemala)

Chilanga Red-painted Usulutan

Ceramic Complexes: Copan - Cueva and Coner
Quirigua - Maudsley (early and late)
Chalchuapa - Vec

Identifying attributes: 1) Red paint along with Usulutan technique decoration over an orange slip; 2) simple animal and geometric motifs; 3) fine cream to buff paste; 4) convex wall (hemispherical) bowl shape dominant; 5) interior usually plain.

Forms: a) Convex wall (hemispherical) bowls with direct rims; sometimes with ring base
b) Composite wall bowls with direct rims

Distribution:

Copan - frequent
Chalchuapa - frequent
Quirigua - frequent
Other observations (frequency not known):
Lower Motagua
Guaytan
Asuncion Mita
Naco Valley
Not present: Zapotitan

Gualpopa Polychrome

Ceramic complexes: Copan - Cueva and Coner
Quirigua - Maudsley (early late)
Chalchuapa - Xocco and Payu

Identifying attributes: 1) Red and black paint on an orange to orange-cream slipped background; 2) simple animal and geometric motifs (similar to Chilanga with additional black paint used as an outline or

fill); 3) fine cream to light buff paste; 4) convex wall (hemispheri- cal) bowl as the dominant shape; 5) interior often plain.

Forms: a) Convex wall (hemispherical) bowls with direct rims; may have slightly restricted orifice
b) Composite wall bowls with direct rim
c) Vertical wall bowls with direct rim, may have slightly recurved walls and slightly restricted orifices

Distribution:

Copan - frequent
Chalchuapa - frequent
Zapotitan - frequent
Other observations (frequency not known):
Lower Motagua
Guaytan
Asuncion Mita

Arambala Polychrome

Ceramic Complexes: Copan - Coner
Chalchuapa - Payu

Identifying attributes: 1) Dull red, black and orange paint on orange slipped background; 2) human, bird and geometric motifs allied with those of Copador; 3) red paste of varying fineness.

Forms a) composite wall bowls with direct or slightly everted rims
b) faceted-flanged composite wall bowls with direct or slightly everted rims
c) convex-wall bowls with direct rim.

Distribution:
Copan - practically absent
Chalchuapa - dominant
Zapotitan - dominant
Quirigua - absent

Other Ceramic Types Cited

The following ceramic types are referred to in the text for comparative purposes. They were not described by Sharer at Chalchuapa nor did they occur in all the three sub-regions studied. The descriptions are abstracted from their sources and inter-site proveniences are mentioned.

Chilama Polychrome

Source: Beaudry 1983

Identifying attributes: 1) Pink paste surface color with white slip; 2) red or orange and back geometric designs

Forms: a) Convex wall bowl with direct rim; b) composite silhouette bowl with direct rim

Inter-site provenience: Zapotitan Valley only, assumed to be a local development.

Sacazil Bichrome

Source: Beaudry 1983

Identifying attributes: Same as Chilama Polychrome except that the black paint is missing

Forms: a) Convex wall bowl with direct rim; b) composite silhouette bowl with direct rim; c) flared wall bowl with slightly everted rim

Inter-site provenience: Zapotitan Valley only; assumed to be a local development

Babilonia Polychrome

Source: Baudez and Becquelin 1973

Identifying attributes: 1) Red, black, brown, and cream paint on an orange slip; 2) variety of geometric and conventional motifs; human heads, false glyphs, animals, and human full figures; 3) variety of forms with diverse supports (tripods) usually rather low

Forms: a) Open bowls with direct rims, concave base; b) tripod bowls with outflared or outcurved walls, various lip treatments; c) cylinder vases, sometimes barrel shaped; d) short necked jars; e) bowls with incurved rim and concave base; f) high necked jars

Inter-site provenience: Lake Yojoa zone (Los Naranjos and other sites); Comayagua Valley; Ulua and Chamelecon Valleys; southern Honduras; El Salvador; Pacific Coast of Guatemala (isolated sherds); Copan

Caterpillar Polychrome

Source: Viel, personal communication 1983; Longyear 1952:100, Fig. 78.

Identifying attributes: 1) Shallow, thick walled dishes on high tripod supports; 2) heavy line decoration usually in specular hematite red and black paint;

3) glyphs and monkeys are frequent motifs.

Forms: a) Large tripod dishes

Inter-site provenience: Copan Valley only; assumed to be a local development.

Note: Only one form was reported by Longyear and commented on by Viel. Ceramic descriptions have not been prepared in a standard form as part of the on-going Copan Project. This type may be more extensive than indicatd by the foregoing description.

APPENDIX C

DESCRIPTION OF BROOKHAVEN PROCEDURES

Sampling

The outer layer of the edge of a sherd or an inconspicuous spot on the surface of a whole vessel is ground away, using a tungsten carbide motor-driven burr. The specimen is then drilled in the cleaned spot using a solid tungsten carbide drill bit. The powder is collected on a clean weighing paper. (Usually the specimen is drilled at several points to provide a more representative, combined sample.) Approximately 100 - 200 mg of powder are obtained and stored in a small glass vial which is labelled with the sample identification. Powdered samples are dried for 18 hours at 110° C and then packaged for bombardment.

Packaging for Bombardment

About 40 mg of each dried sample is weighed to the nearest 0.01 mg into a quartz ampoule. (The ampoules are prepared from ultra-high purity Suprasil T-20 mm i.d. fused quartz tubing by sealing at one end, boiling in aqua regia, rinsing with distilled water and drying.) After weighing in the sample, the quartz ampoule is sealed off in vacuo and labeled with India ink. Empty labeled ampoules are also included with each run as a check on the purity of the silica and ink. Sealed ampoules are touched only with tweezers or cotton gloves after cleaning and before bombardment. The group of ampoules to be activated is sealed into an envelope of ordinary quartz which then enters the reactor in an irradiation can.

Use of Standards

Brookhaven includes standards in each run along with the unknown samples being bombarded. If the concentration of elements in a standard are accurately known, then the concentration of the same elements in the unknown samples can be established through simple ratios of the recorded signals of the radiations representing the different radioisotopes in the standard and the unknown. Standards are 6 U.S.G.S. analyzed rocks, designated as AGV-1, BCR-1, DTS-1, PCC-1, GSP-1, and G-2. Samples of these rocks have been analyzed by many laboratories and Brookhaven researchers have prepared a table of "best values" using Chauvenet's Criterion to reject extreme values (Abascal et al 1974). Not every standard rock is used to calibrate every element (see Bieber et al 1976 for choice and rationale).

Rock standards are weighed out, dried, encapsulated, bombarded and counted together with each group of ceramics.

Bombardment with Neutrons

The many radioisotopes activated by neutrons in pottery decay with a variety of half-lives. For this project only the longer-lived isotopes were measured during a long-duration bombardment. This was carried out at the Brookhaven High Flux Beam Reactor. The long activation was made for 3.5 hours in the core position at fluxes up to 5 x 10^{14} neutrons/cm^2 sec to activate the longlived elements. The samples were then cooled 9 days, loaded into a sample changer connected to the germanium counter, and counted for 4000 seconds.

Counting

The detector used is a Princeton Gammatech 7% Ge-Li crystal of 1.82 KeV resolution on cobalt-60. Samples are fed to the detector by a 48-position sample-changer. The pulses from the detector are amplified and fed to a Nuclear Data 2400 4096-channel pulse height analyzer modified to record not only the gamma spectrum but elapsed time, spectrum tagword and date on a magnetic tape. Dead time was corrected by means of a special, locally-designed, all-solid-state pulser. Reliable peak values are obtained for the 16 elements: Rb, Cs, Ba, Sc, La, Ce, Eu, Lu, Hf, Th, Cr, Fe, Co, Ca, Sm, Yb.

Preliminary Data Processing

The raw gamma spectra are analyzed by the program BRUTAL which yields intensities of the gamma rays corrected for background and sample weight. The output cards from BRUTAL form the input to Brookhaven-developed programs ELCALC and SMPCALC which apply decay and dead-time corrections, calculate calibration coefficients, average them, and ultimately calculate and punch out the analytical data for each ceramic specimen. These ceramic sample data cards (two per specimen) contain space for up to 36 elements, reported as element oxides (Abascal et al 1974).

APPENDIX D

DEFINITION OF TERMS USED IN DESCRIBING DECORATION VARIABLES

The most detailed and most quantitatively oriented work on ceramic design analysis has been done on materials that used primarily abstract designs (Shepard 1948; Washburn 1977 - pg 11 for discussion of work using symmetry clases for the analysis of design; Plog 1980)

The designs on Copador and, to a somewhat lesser extent, on the other painted ceramics being studied are not primarily abstract. They are representational (both naturalistic and conventionalized, i.e., simplified, using part to represent the whole) or glyphic. Thus, some of the concepts and the terms may be used slightly differently than in other design studies.

Design element -- usually referred to as a basic geometric shape or "the simplest regular part" of the design (Shepard 1971b:266). This term will not be used in this work because of its inferred association with simple geometric patterns.

Motif -- a figure composed of a number of component parts which by repetition on the same vessel or across vessels appears to have been associated as a unit by potters. It is recognized that a certain degree of subjectivity is involved in this definition. However, the motif catalog included in Appendix F can be used, if desired, to reinterpret motifs on a more elemental basis.

Motif combinations -- Description of the overall decoration on a given part of the vessel surface coded so that each vessel can fit into only one category. A glance at the variable states for the various vessel shape groups (Tables 39 through 43) and at the motif catalog (Appendix F) will clarify the distinction between motif and motif combination. A total of 164 motifs were registered during the recording process. However, for much of the analysis fewer than 15 motif combinations were used for a given shape within a type.

Discrete or finite motif -- "free standing" designs that may be repeated on a vessel but are not formally joined together.

Continuous motifs -- Patterns that are repetitive and may be organized in two ways: a) in a horizontal band

circling the vessel; b) covering areas of the vessel (could be wider than a band pattern).

Design field -- conceptualization of the shape in terms of how it can be divided for decoration. Shapes vary with regard to how many spatial "boundaries" the design field is perceived to have. Hardin (1979) discussed how specialist pottery painters in Mexico use an analytic system to divide the surface of the vessel into a series of spatial divisions, some of which might optionally be further subdivided. Shepard (1971b:261-63) discusses the effects of curvatures and angles on limiting the decorative field.

Register -- A horizontal bounded division of the design field within which motifs are organized. The "boundary" usually is formed by one or more painted bands or by changing the color of the ground (e.g., from slipped to solid painted with designs set off in medallions).

Band -- A solid-painted horizontal line used in a boundary area between registers, between the rim and the first register, between the register and the interior botton. There were a few instances where the width of a solidpainted horizontally oriented area led to the question of whether to classify it as a band or a register. A solidpainted horizontally oriented area was classified as a band if it was 2.9 cm or narrower, as a register if it was 3.0 cm or wider. In spite of this operational decision based on width, a horizontally bounded area with a painted motif (usually continuous) was considered a register regardless of its width.

Panel -- A vertically oriented division or organization of motifs; is considered within the horizontal register organization of the design field.

Rim band -- A solid band of paint covering the area from the margin of the vessel orifice down onto the wall or side some specified distance.

Rim Area -- Used to designate the part of the vessel from the lip (edge or tip of rim) down to the first spatial division or boundary when a rim band is not used. This was infrequently observed; it occurred more often on the interior of a vessel when some simple motif was used rather than the standardized rim band was used.

APPENDIX E

Forms Used in Recording Vessels For Production-Step Decision Analysis

PAINTED CERAMICS RECORDING FORM (4)

COL.- CARD 1		COL.-CARD 2		COL.-CARD 3	
1-6	ID #:	1	#bnds blw 3rd reg.	1	int.rim
7-8	Field Prov	2	1st band, color	2	inter.rim colr
9	Vesl condtn	3-4	1st band, width	3-4	inter.rim wdth
10	Est. type	5	2nd band, color	5-6	inter.spec.dec.
11-12	Sharer var.	6-7	2nd band, width	7	inter.wall fnsh
13	Vessel cat.	8	3rd band, color	8	#bnds rim-wall
14	sidewall dir.	9-10	3rd band, width	9	color,1st bnd
15	base	11	# reg, exterior	10-11	width, 1st band
16-17	spec. shape	12-14	1st reg. depth	12	color,2nd band
18-20	rim diam.	15-17	1st, main motif	13-14	width,2nd band
21-23	height	18-20	1st, 2nd motif	15	color,3rd band
24-25	thickness	21-23	1st, 3rd motif	16-17	width,3rd band
26	slip color	24-26	1st, 4th motif	18	color, 4th band
27-28	paint colors	27-28	1st paint colors	19-20	width,4th band
29	luster	29-30	1st repeats	21	#bnds,wall-botm
30	smearing	31-33	2nd reg. depth	22	color,1st band
31	craftsmanship	34-36	2nd main motif	23-24	width,1st band
32	ext. rim	37-39	2nd, 2nd motif	25	color,2nd band
33	ext. rim color	40-42	2nd, 3rd motif	26-27	width,2nd band
34-35	ext.rim width	43-44	2nd, paint colors	28	color,3rd band
36-37	ext. spec decor.	45-46	2nd repeats	29-30	width,3rd band
38	#bnds rim-1st reg.	47-49	3rd reg, depth	31	color,4th band
39	1st band, color	50-52	3rd, main motif	32-33	width,4th band
40-41	1st band, width	53-55	3rd, 2nd motif	34-36	depth,int.reg.
42	2nd band, color	56-58	3rd, 3rd motif	37-39	wall,main motif
43-44	2nd band, width	59-60	3rd, paint colors	40-42	wall,2nd motif
45	3rd band, color	61-62	3rd, repeats	43-44	wall colors
46-47	3rd band, width	63	base/wall	45	wall repeats
48	#bnds blw 1st reg.	64-65	ext. base dec.	46-48	btm motif
49	1st band color			49-50	btm color
50-51	1st band, width			51-52	comments
52	2nd band, color			53-55	4th reg.ext.dpth
53-54	2nd band, width			56-58	4th, main motif
55	3rd band, color			59-61	4th,2nd motif
56-57	3rd band, width			62-63	4th, color
58	#bnds blw 2nd reg.			64-65	4th, repeats
59	1st band, color			66	#bnd 1-2 reg,int.
60-61	1st band, width			67	1st band, color
62	2nd band, color			68-69	1st band,width
63-64	2nd band, width			70	2nd band,color
65	3rd band, color			71-72	2nd band,width
66-67	3rd band, width				

Blank=piece not have it
0=can't tell if has it -- obliterated, part miss., using photo, etc.

(Trial 3; card layout for design element analysis)

Card 1

Col
(6)1-6 ID number (incorporates current location)

01 Peabody
02 Smithsonian
03 Guatemala National Museum
04 Instituto Hondureno, Tegucigalpa
05 Copan Archaeological Project Headquarters
06 Copan Museum, Honduras
07 Comayagua Museum, Honduras
08 Bonilla Gastel collection, San Pedro Sula, Honduras (01 for Sta. Barbara lot)
09 Mario Lopez sherds, San Pedro Sula, Honduras
10 Maegli Collection, Guatemala
11 Museo Popul Vuh, Guatemala
12 Banco Atlantida, Tegucigalpa, Honduras
13 Museo Nacional, San Salvador
14 Berlin Museum (from Gordon and Mason plates)
15 University of Pennsylvania
16 Fenton Collection (from Gordon and Mason plates)
17 Zapotitan Valley, Salvador

Other 4 columns for collection numbers, righthand justify.
On Honduran specimens when have Inventory and Catalog number, use catalog number for ID.
000=no number at location. At PV used 11-001,2,3,4, for vessels w/o number; used 11-1/2-64 when duplicate number

(2) Field Provenience

01 Copan - ceremonial center, unspecified
02 Copan - ceremonial center, tomb (burial construction)
03 Copan - ceremonial center, Mound 36
04 Copan Valley - unspecified
05 Copan Valley Project, CV 20
06 Copan Valley Project, CV 43
07 Copan Valley Project, CV 16
08 Copan Valley Project, other
09 Copan Valley, Las Sepulturas
10 Copan Valley, Monte Grueso
11 Quezailica
12 Other western Honduras
13 Honduras -- specifics unknown
14 Guatemala -- specifics unknown
15 Rio Hondo/Zacapa/Estanzuela
16 Asuncion Mita
17 San Agustin Acasaguastlan
18 Kaminalyuju
19 Salvador - unknown
20 Tazumal - tombs
21 Western Guatemalan highlands
22 Copan Center, burial but not tomb construction
23 Copan Center - Mound 32
24 Piedras Negras

Col

(2) 7-8 Field Provenience (cont'd)

25 Copan Center - cache/vault under stela
26 Copan Center - Mound 41
27 South Coast, Guatemala
28 Copan Center - construction associated
29 Copan Valley - construction associated (CAP)
30 Copan Valley - tomb (CAP)
31 Copan Valley - burial, not constructed tomb (CAP)
32 Tazumal - construction associated
33 Cambio and Ceren site, El Salvador

41 Purchased San Miguel, Salvador
00 Unknown (private collection; can not attribute to country of origin)

(1) 9 Vessel condition

1 Whole vessel
2 Partial vessel
3 Sherd
4 Whole vessel, restored

(1) 10 Established type

1 Copador
2 Arambala
3 Gualpopa type
4 Chilanga
5 Ulua-Yojoa (Babilonia)
6 Chichipate
7 Motagua type 1
8 Copador related or aberrant Copador
9 Gualpopa Group: Paxte scraped slip
0 Caterpillar

(2) 11-12 Sharer variety

01 Glyphic A, Copador
02 Glyphic B, Copador
03 Glyphic C, Copador
04 Glyphic D, Copador
05 Glyphic E, Copador
06 Figure A, Copador
07 Figure B, Copador
08 Unspecified by Sharer
09 Exterior Figure B but interior no decoration
10 Exterior Glyphic C but interior not decorated
11 Exterior Glyphic E, but interior not decorated
12 Exterior Glyphic B but interior not decorated
13 Exterior Glyphic C but interior not decorated
14 Exterior Glyphic A but interior not decorated

Col

(2) 11-12 Sharer variety, cont'd

15 Glyphic A except glyphs are not standard A - C
16 Glyphic B except that there are not glyphs in 1st register
17 Glyphic C except it also has glyph in register with seated figure

21 Arambala, Arambala variety
22 Arambala, Glyphic A
23 Arambala, Glyphic B
24 Arambala, Glyphic C
25 Arambala, Figure A
26 Arambala, Figure B
27 Arambala, Figure C

31 Gualpopa, Gualpopa Variety
32 Gualpopa, Geometric Variety
33 Gualpopa, Mono Variety
34 Gualpopa, Glyphic Variety
35 Gualpopa, variety unspecified by Sharer

41 Chilanga, Chilanga Variety
42 Chilanga, Osicala Variety

(1) 13 Vessel Category

1 Plate (height less than 1/5 diameter)
2 Dish (height between 1/3 and 1/5 diameter)
3 Bowl (height no less than 1/3 nor larger than diameter)
4 Vase (height greater than diameter)
5 Vertical neck jar
6 Outflared neck jar
7 Outcurved neck jar
8 Incurved neck jar
} Height greater than maximum diameter plus has independent restricted orifice (inflection point above equator)
9 Cup (11 cm or lower)

(1) 14 Side wall direction

1 vertical
2 flared
3 outcurved
4 round/incurved slightly
5 incurved markedly
6 Recurved with vertical neck
7 Recurved with outflared neck
8 Recurved with outcurved neck
9 Incurving neck, recurved

Col

(1) 15. Base

1 Convex
2 Flat
3 Concave
4 Special: gadrooned-rounded,dimple,interior "hump" exterior flat,et
5 Tripod, low (5 cm or less)
6 Tripod, high (more than 5 cm)
7 Tetrapod
8 Ring-based, low (3 cm or less)
9 Ring-based, high (more than 3 cm
0 missing

(2) 16-17 Special shape

01 Basal flange
02 Basal angle
03 Faceted flange
04
05 Radial or diagonal grooving
06 Effigy (modeled/appliqued)
07 Fluting (close-up channels)
08 Grooving - vertical
09 Flattened lip
10 Ridge thickening lip
11 one or two horizontal grooves on side wall
12 ring base enclosed and perforated
13 rounded, exterior thickened rim
14 rounded handle
15 tripod with ovoid supports
16 base elaborated with deep grooves,separating into 6-petalled form
17 tripod with slab supports
18 applique knob/ "boss"
19 ridge on side wall
20
21 ridge and horizontal groove
22 ridges on exterior (horizontal)
26 both 02 and 06
27 both 02 and 07
38 both 03 and 08
78 both fluting and horizontal grooves
(Note: gadrooning = combination of grooving and modelling)

(3) 18-20 rim diameter(record in mms)

(3) 21-23 height (record in mms; if piece has base, exclude base from measure.)

(2) 24-25 thickness (record in mms)

(1) 26 slip color

1 orange and cream
2 orange
6 white/cream
9 none

(2) 27-28 paint colors (recorded in combination)

01 Black orange, s.h. red
02 black, orange, non-specular hematite red
03 orange, s.h. red
04 black, s.h. red, grey
05 black, s.h. red
06 black, non-specular hematite red
07 black, orange, s.h. red, purple
08 orange, non-specular hematite red
09 black, orange, s.h. red, grey
10 black, orange, s.h. red, grey, pink
11 black, s.h. red, grey, deep "burnt" orange
12 black, orange, s.h. red, white/cream
13 black
14 red (either s.h. or non-s.h.)
15 black and orange
16 black, orange, grey
17 orange
18 black and grey
19 black, s.h. red, cream
20 solid red, non specular hematite, with black designs painted
21 black, non-s.h. red, grey
22 black, orange, s.h. red, pink

33 specular hematite red
44 non-s.h. red

(1) 29 luster

1 high
2 medium
3 low
4 1/2
5 2/3

(1) 30 smearing

1 yes
2 no

(1) 31 craftsmanship

1 finely executed
2 careful, but not outstanding
3 a little sloppy
4 very careless
5 1/2
6 2/3
7 3/4

(1) 32 Exterior rim (decoration)

1 band of color
2 no rim band, but area separated from first register and decorated
3 none; register starts directly from rim
4 band on lip only

0 rim missing

(1) 33 Exterior rim color

1 black
2 orange
3 specular hematite red
4 non-specular hematite red
5 grey
6 white/cream
7 special: pink/purple/burnt orange/black over red at lip,red contin.
8 red over black
9 black over red
0 missing

(2) 34-35 exterior rim(band)width -- record in mms

(2) 36-37 Exterior special decoration (if solid band not used at rim or if something other than standard register and solid bands is on piece)

01 Motif 056 above and below 1st register
02 wavy line with dots above 2nd register, below standard bands
03 motif 049 above 1st register
04 motif 104 spaced around rim (7 repeats) into what consider rim band
05 spiral bowl
06 blotchy Usulutan
07 wavy line Usulutan (or scraped slip)
08 variation of spiral bowl
09 obliterated, can't determine details
11 not standard register; applique decoration between painted bands
56 spiral bowl with blotchy resist
71 linear Usulutan in plaid pattern
10 glyphs in diagonal panels in solid painted register

(1) 38 Number of bands between rim and first register

(1) 39 Color, 1st band between rim and first register

1 black
2 orange
3 specular hematite red
4 non-specular hematite red
5 grey
6 white/cream

Col

(2) 40-41 Width of first band (record in mms)

(3) 42-44 color and width of second band between rim and first register

(3) 45-47 color and width of 3rd band between rim and first register

(1) 48 number of bands below 1st register (note: 9= no bands used but piece has 2 sets of motifs and are treated as 2 separate registers)

(3) 49-51 color and width of 1st band below 1st register

(3) 52-54 color and width of 2nd band below 1st register

(3) 55-57 color and width of 3rd band below 1st register

(1) 58 number of bands below 2nd register

(3) 59-61 color and width of 1st band below 2nd register

(3) 62-64 color and width of 2nd band below 2nd register

(3) 65-67 color and width of 3rd band below 2nd register

CARD 2

(1) 1 number of bands below 3rd register

(3) 2-4 color and width of 1st band below 3rd register

(3) 5-7 color and width of 2nd band below 3rd register

(3) 8-10 color and width of 3rd band below 3rd register

(1) 11 number of registers on exterior

(3) 12-14 depth of first register, exterior (record in mms)

000 incomplete or missing
999 spiral bowl, no registers

(3) 15-17 first register, main motif (if can be determined)

(3) 18-20 first register, 2nd motif

(3) 21-23 first register, 3rd motif

(3) 24-26 first register, 4th motif

(2) 27-28 first register, paint colors (record in combination as for overall vessel paint)

Col (Card 2)

(2) 29-30 First register repeats

0 - 98, as indicated
11 - 89 repeats of each motif, motifs alternate
99 - continuous
88 - unusual repeat, see comment section
00 - incomplete piece, can't tell repeats

Note: if 2 motifs alternate but there is uneven number of each, use 1st col[m] for repeat of 1st motif and 2nd column for repeat of 2nd motif
If there are more than 2 motifs, repeats will refer to first two listed

(3) 31-33 Depth of second register (in mms)

000 incomplete or missing

(3) 34-36 2nd register, main motif

(3) 37-39 2nd register,2nd motif

(3) 40-42 2nd register, 3rd motif

(2) 43-44 2nd register, paint colors (record in combination)

(2) 45-46 2nd register, repeats

(3) 47-49 3rd register, depth (in mms)

(3) 50-52 3rd register, main motif

(3) 53-55 3rd register 2nd motif
(3) 56-58 3rd register, 3rd motif
(2) 59-60 3rd register, paint colors (record in combination)

(2) 61-62 3rd register, repeats

(1) 63 base/wall

1 paint ends but slip may continue
2 paint continues onto base
3 outlined with red band
4 design incorporates base
5 no special demarcation
6 outlined with black band
7 painting and fluting ends
8 fluting/grooving ends
9 not applicable,ring base or tripod

(2) 64-65 Exterior base decoration

01 unpainted, but may be slipped
2_ solid paint (use 2nd column for color)
02 paint and fluting ends
03 melon strip (colors will be same as on exterior wall)
04 orange and red "cattail" motif
05 radial stripes
6_ single outlining stripe or band, not at base/wall juncture (use 2nd column for color)

Col. (Card 2)

(2) 64-65 Exterior base decoration, con't)

07 paint ends beyond base/wall juncture; center has only slip
8_ dot in center of concave base (use 2nd column for color)
9_ spiral motif (use 2nd column for color)
10 2 bands; different colors and widths
11 base is part of wall design
12 base part of wall design plus additional dot
99 not applicable, ring base or tripod

CARD 3

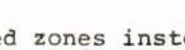
(1) 1 interior rim (decoration)

1 band of color
2 no rim band but area separated from first register and decorated
3 none;register starts directly from rim
4 lip only

(1) 2 interior rim color
1 black
2 orange
3 specular hematite red
4 non-specular hematite red
5 black and red
6 special: white/cream/grey/pink
7
8 red over bladk
9 black over red

(2) 3-4 interior rim width (in mms)

(2) 5-6 interior special decoration (if solid band not used or if area below rim used for other than standard series of bands and register)

01 notched line 
02 alternating black and red-painted zones instead of solid band
03 fret and dot
04 blotchy resist
05 broad line resist
06 wavy line Usulutan
07 painted red zones alternating with black dots
08 dots between bands
09 4 painted zones
10 alternating

(1) 7 Interior wall finish (if not divided into registers)

1 wall slipped
2 not slipped
3 neck only slipped
4 slip plus isolated elements on wall; bottom has no design
5 scraped slip

Col (Card 3)

(1) 8 Number of bands between rim and wall, interior

(1) 9 Color, 1st band

(2) 10-11 width, 1st band

(3) 12-14 color and width, 2nd band

(3) 15-17 color and width, 3rd band

(3) 18-20 color and width, 4th band

(1) 21 number of bands, interior wall- bottom (or between 2nd reg & bottom if more than one reg on interior)

(3) 22-24 color and width, 1st band

(3) 25-27 color and width, 2nd band

(3) 28-30 color and width, 3rd band

(3) 31-33 color and width, 4th band

(3) 34-36 depth, interior register (in mms)

(3) 37-39 interior wall, main motif

(3) 40-42 interior wall, 2nd motif

(2) 43-44 interior wall, colors (record in combination as for overall paint)

(1) 45 interior wall repeats. 9=something special check comments & coding sheet; when there is more than one motif, a # means each alternates

(3) 46-48 interior bottom motif and has this number of repeats

(2) 49-50 interior bottom colors (record in combination, as for overall paint)

(2) 51-52 Comments (surface/design)

01 firing cloud
02 small extra figures
03 stuccoed
04 special repeat pattern, see recording page
05 repair holes
06 bands of orange painted under main designs
07 line of smaller motifs above main figures
08 drips of paint showing
09 registers separated by ridge
10 special grooving pattern, sets off registers
11 special grooving pattern, outlines circle-dot motif
12 10 and 11 in combination
13 bottom shows lots of wear; paint or slip worn away at least partially
14 refired
15 refired & lots of wear
16 3rd motif in interior register, 149
17 3rd motif in interior register, 052 (only one)

Col (Card 3)

(2) 51-52 Comments (surface/design) (cont'd)
18 stuccoed piece which has 5th band (black, .01) on interior
19 1st register interior=solid red; see recording for width
20 1st register interior=motif 125, see sheet for width
21 linked spirals above and below main motifs in registers
22 crosshatching painted on outside of slab supports.
23 more than 1 motif in interior; see coding sheet
24 1st register interior=motif 048, width & color on coding sheet
25 refired and with drips of paint showing (14,8)
26 3rd motif in interior register, 038
27 1 and 13 in combination
28 third motif in interior register, 004
29 additional bands and/or registers on exterior
30 29 + 01

(3) 53-55 4th reg, ext, depth (record in mms)

(3) 56-58 4th reg, main motif

(3) 59-61 4th reg, 2nd motif

(2) 62-63 4th reg, colors

(2) 64-65 4th reg, repeats

(1) 66 number of bands, 1 and 2 register, interior

(1) 67 1st band color

(2) 68-69 1st band, width

(1) 70 2nd band, color

(2) 71-72 2nd band, width

APPENDIX F

SUMMARY OF MOTIFS BY TYPE OF DESIGN

Glyphic

001 Glyph A, main sign on right
002 Glyph A, main sign on left
003 Glyph A, variant
005 Glyph B, main sign on right
006 Glyph B, main sign on left
007 Glyph B, main sign only
008 Glyph B, variant
009 Glyph C, facing right
010 Glyph C, facing left
011 Glyph C, variant
031 Glyphs (not A,B, or C) horizontally arranged
032 Glyphs (not A,B, or C) in a vertical panel
133 Affix only of "standard" A,B,C, glyphs
135 "hand" glyph

Human Representations

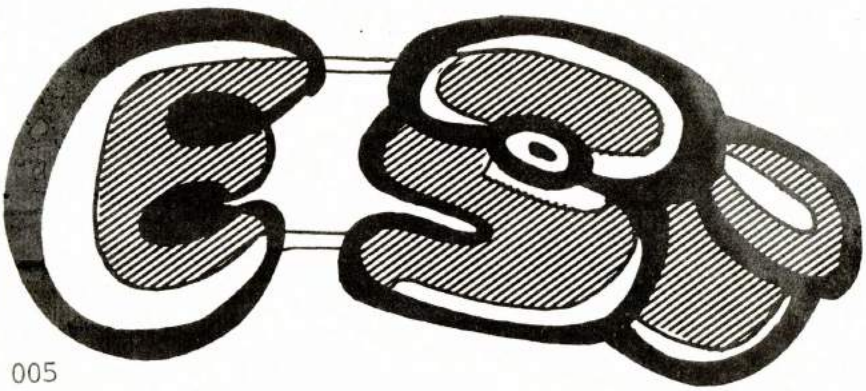
012 Swimming figure, facing right
013 Swimming figure, facing left
014 Seated figure, facing right
015 Seated figure, facing left
016 Variant of seated figure, facing right
017 Variant of seated figure, facing left
023 Standing figure, facing right
024 Standing figure, facing left
130 Indeterminate human figure
158 Grotesque face

Animal representations

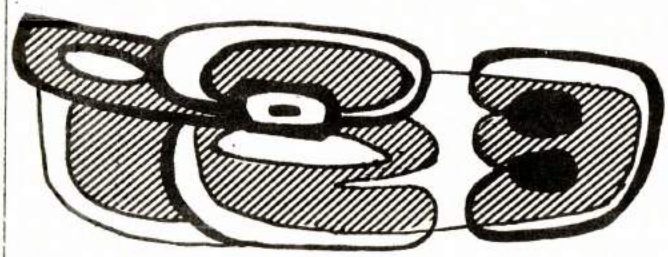
Birds

018 Bird without element in mouth
019 Variant of bird without element in mouth
020 Bird with element in mouth
021 Variant of bird with element in mouth
022 Hooked-beak bird
073 Bird effigy
114 Bird silhouette
148 Stylized bird

Glyphs

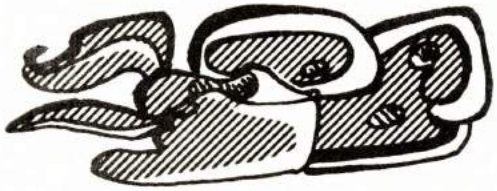


005



006 (outline is red)

009



008 (outline is red)

010

009

011

Glyphs (continued)

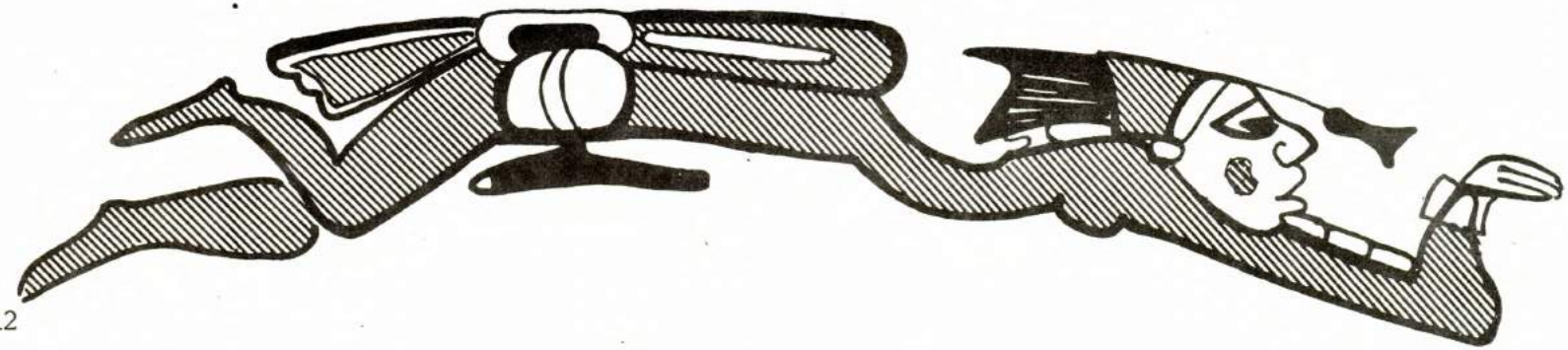
031

030

032

135

Human representations

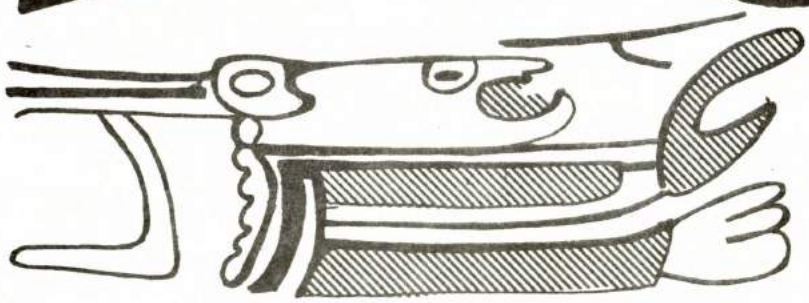


012

012

Human representations (continued)

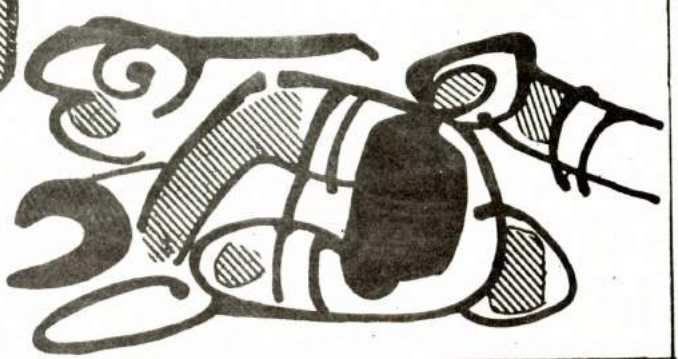
014



014

015

017



017
(on Arambala)

Human representations (continued)

023

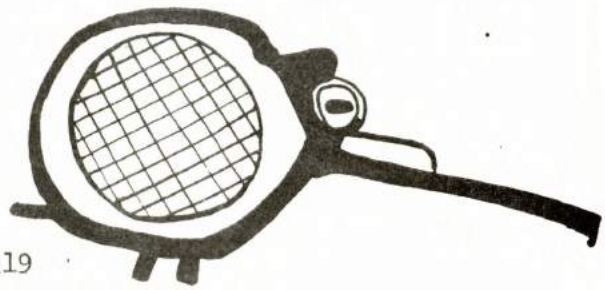
016

024

158 (design obliterated in part)

Animal representations - Birds

019



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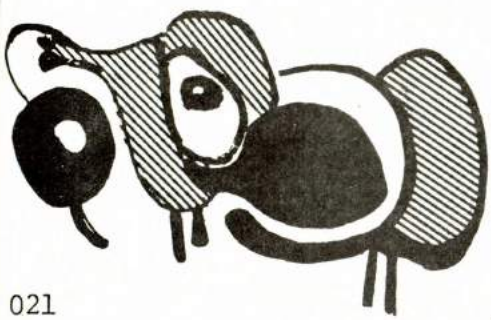

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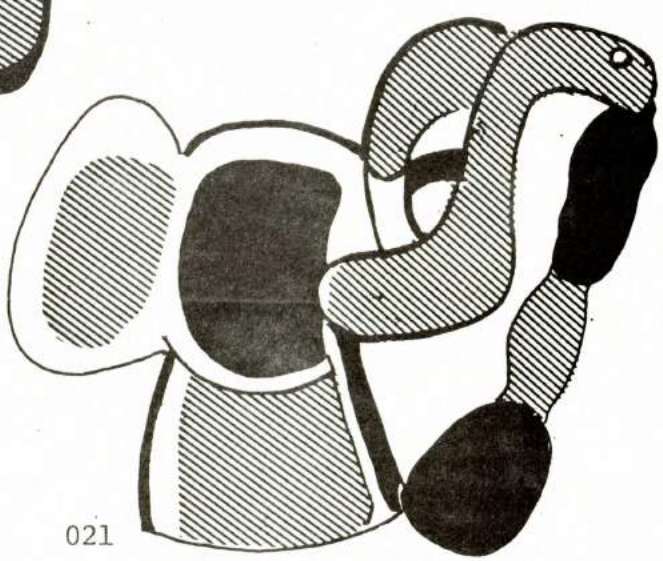
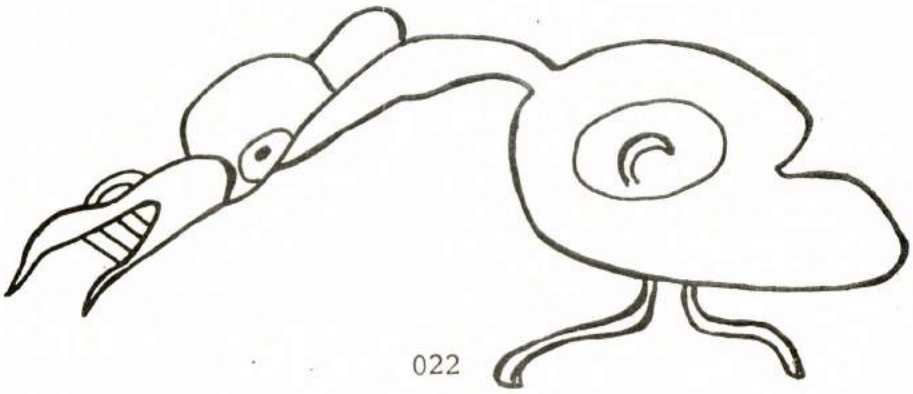


021

Animal representations - Birds (continued)

022



022

114

148

Monkeys

029 Monkey
030 Seated monkey

Serpent

027 Serpent figure facing right
155 Stylized feathered serpent

Other

072 Frog effigy (subsumes various specific details that may vary).
071 Effigy - indeterminate animal
121 "Turtle" design
131 Very elongated jaguar
154 Bat with outstretched wings
157 Indeterminate animal

Bar and dot numbers

052 Bar and dot 8
053 Bar and dot 7
054 Bar and dot 8 with dots on both sides of the bar
055 Bar only, dots missing (used only in context with complete bar and dot)

Abstract patterns

Continuous (in band around circumference of vessel)

039 Linked scrolls
048 Horizontal zigzag or wavy line(s)
051 Scalloped line
056 Linked spirals
058 Attached rectangles with exterior dots
067 Dots and vertical lines
069 Band with suspended "commas"
077 Linked scrolls with dots
100 Linear pattern
107 Notched line or band
125 Triangles with interior dots
113 Series of "U" shapes alternating with areas of solid paint
117 Band with suspended spirals

Animal representations - Monkeys

029

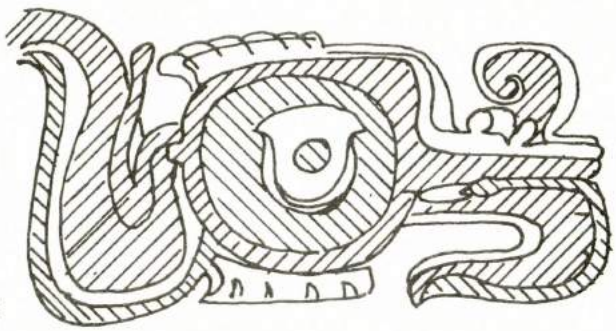
030

030

Animal representations

Serpents

027



155

Other

121

154

039

048

051

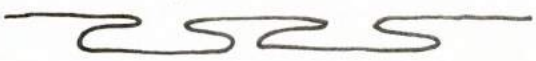
056

058

067

069

077

100 

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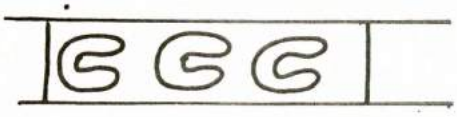
125

113 

Continuous patterns organized in horizontal band around vessel

Continuous (covering areas of the vessel not necessarily running horizontally around the vessel)

041 Crosshatched zones
037 Crosshatch with suspended dots
123 Crosshatch with interior dots
159 Curvilinear pattern with dots
042 Panels of solid color (usually setting off glyphs or figures in the same register)
044 Register of solid color
047 Medallion effect given to another element
000 Plain, no motif, not painted, outlined with bands

Simple discrete element

Lines

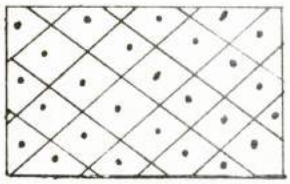
043 Groups of vertical parallel straight lines
045 Groups of vertical and horizontal lines
068 Melon stripe (alternating colors black and red; width varies by contour)
078 Series of parallel horizontal lines (on a variety of Gualpopa are diagonal)
096 Vertical wavy or zigzag lines
105 Combination of vertical straight and squiggle lines
118 Single vertical or diagonal line
111 Series of vertical straight lines separated by a line of dots
147 Horizontal bands (in an area considered a "register," e.g., below curve of recurved bowl)

Shapes

038 Dot(s)
057 Unattached "S"'s, vertical or horizontal, rounded or angular
060 U shape, vertical or horizontal (Smith's bracket)
075 Unattached spirals
086 Chevrons
093 Double triangles
101 Horizontal "H"
102 Single triangle, upright or inverted
112 Geometric figure
119 Half-disc
137 Spiral in circle
149 "Doughnut" shape
046 "Shell" element
061 Variant of shell
064 Curvilinear shape
076 "Winged" element
106 Geometric figure
115 Curvilinear design
136 Pair of "E"'s
139 Geometric figure

037

123



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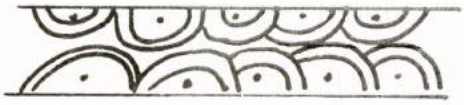
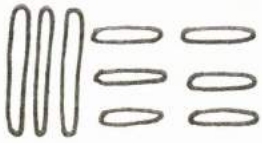


Continuous (covering areas of the vessel not necessarily running horizontally around the vessel)

043

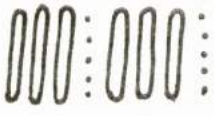
045



078

118

111



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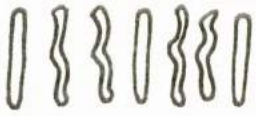


Simple discrete elements, lines

143 Half-disc with interior fill
145 Shell varient
126 Geometric design (open ovals with horizontal line)

Circular/curvilinear designs (most occur on vessel bottom)

033 Circle and dot
034 Rosette (with circle and dot included)
035 Cross-bands
036 Cross-bands with dots
059 Rectangles angling off band on exterior bottom
140 Circular "flower" effect
141 Circular "flower" effect
129 Ovoid design
162 Rosette with cross-bands

G-fret and scroll, step fret

049
063
116

Combination circular and rectilinear designs

062
122

Abstract, could represent an animal or bird

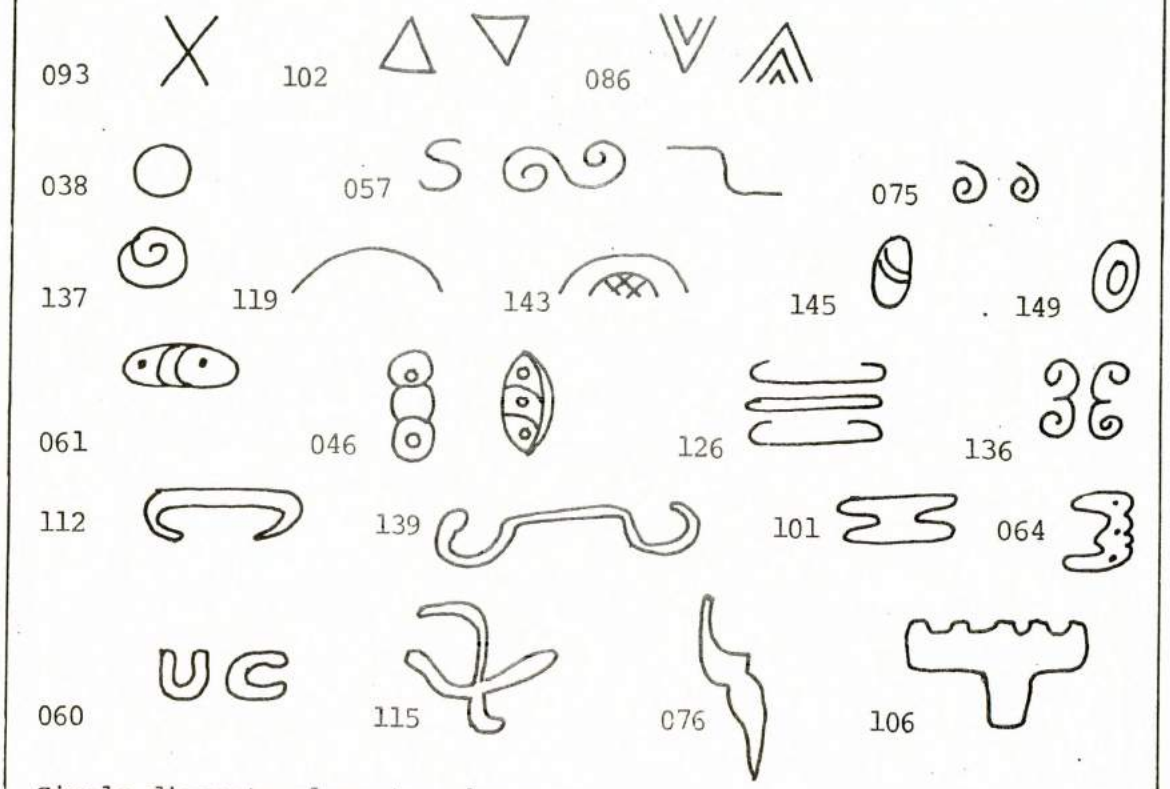
082
088
089

Abstract, chevrons plus other elements

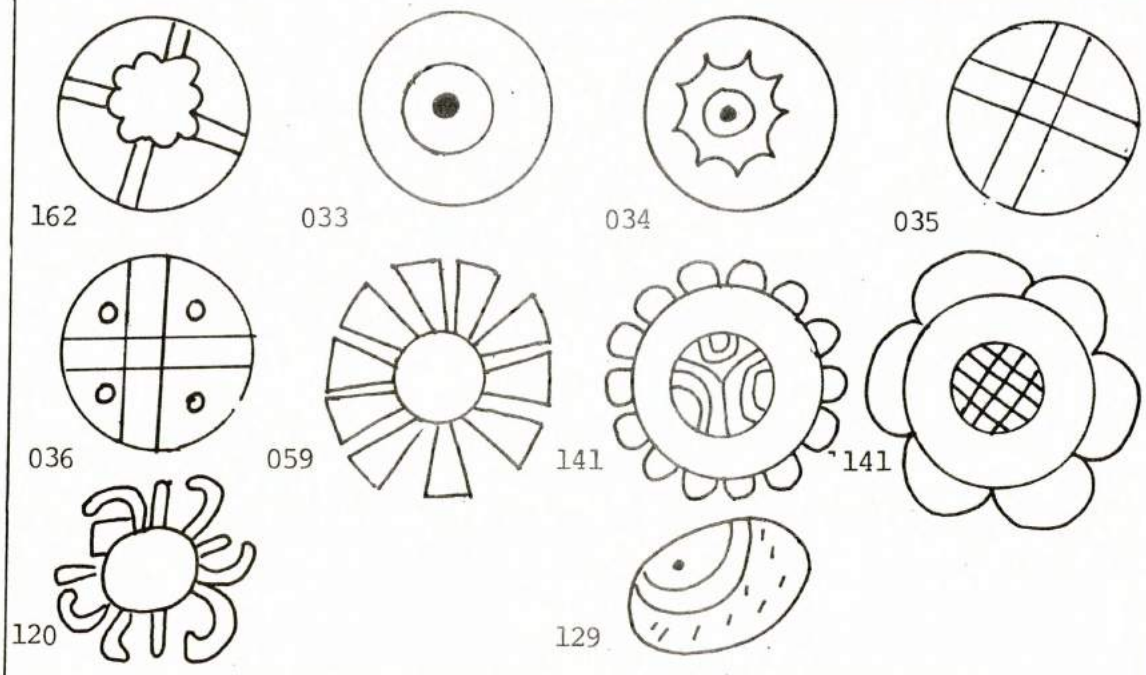
070
081

Variations of St. George cross

099
128



Simple discrete elements, shapes

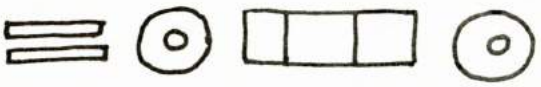


Circular/curvilinear designs (most occur on vessel bottoms)

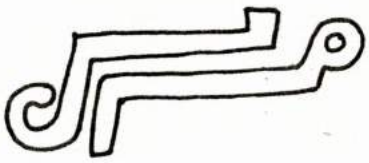
049 049 049

116 063

G-fret and scroll, step fret

062  122

Combination circular and rectilinear designs

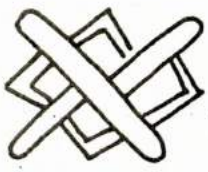
082 088 

089

Abstract, could represent an animal or bird

070 181

Abstract, chevrons plus other elements

099 128 

Variations of St. George cross

Complex U shapes or bracket arrangements

065
066
083
087
090
091
092
138
150
124

Patterns incorporating hooked or "saw-tooth" lines

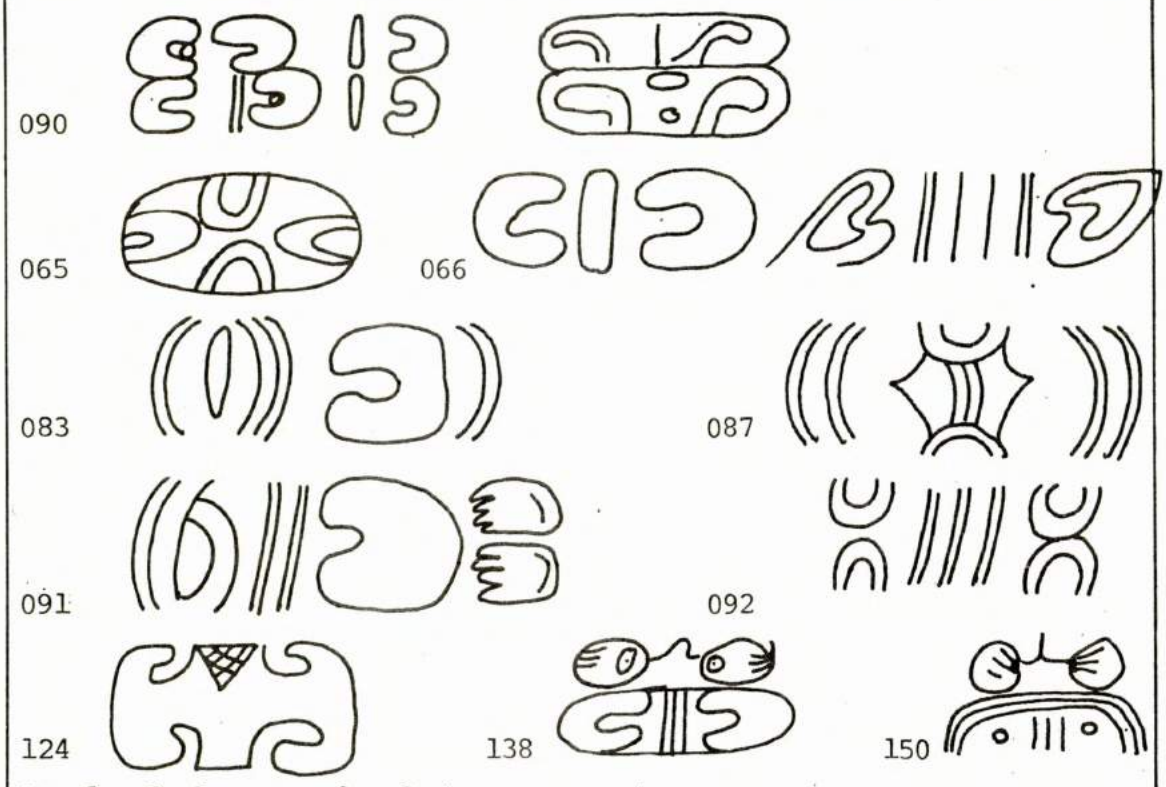
079
080
094
097
160

Knotted rope motif; interlaced linear designs

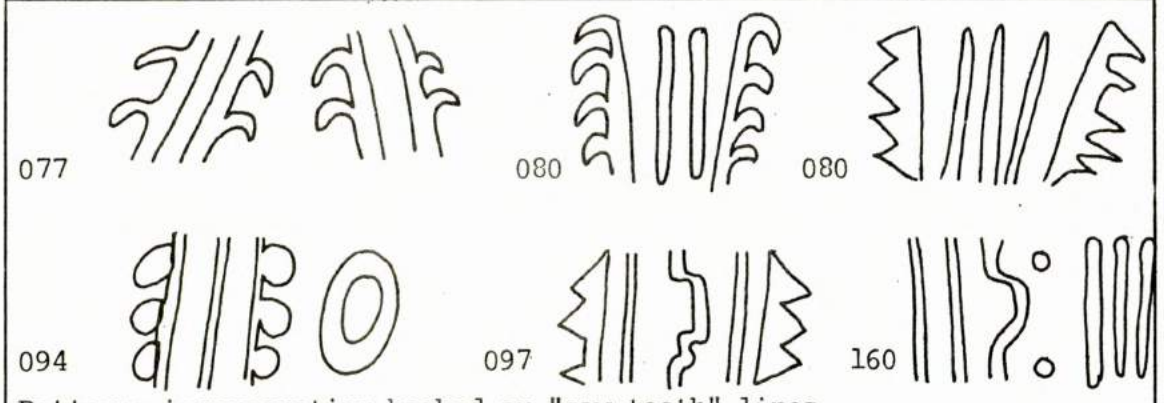
050
040

Miscellaneous

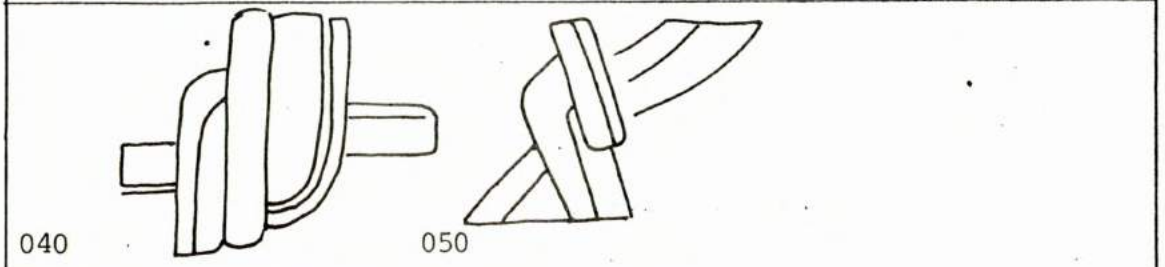
103 Crossed hooked lines
074 "cattail"
132 Elaborate banners of varied color
151 Indeterminate design in medallion shape
152 Abstract geometric design in medallion (may be bird
head in one repeat)
085 Pair of facing geometric elements
108-110 Complicated geometric design, may be allied to Smith's "sky band symbol, Ilhuitl sign" [Smith 1955:
74])
084 Abstract curvilinear design
153 Possible shell variant
156 Elaborate guilloche pattern



Complex U shapes or bracket arrangements

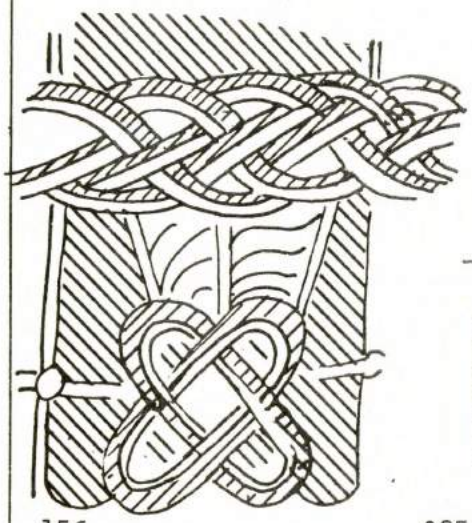


Patterns incorporating hooked or "saw-tooth" lines



Knotted rope motif; interlaced linear designs

Miscellaneous



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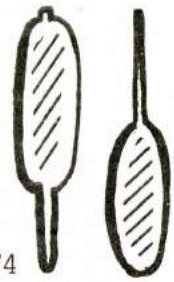

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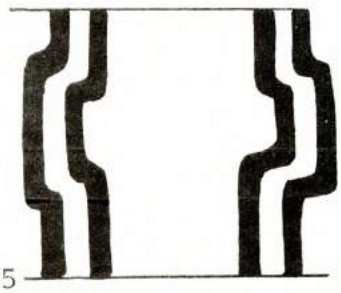
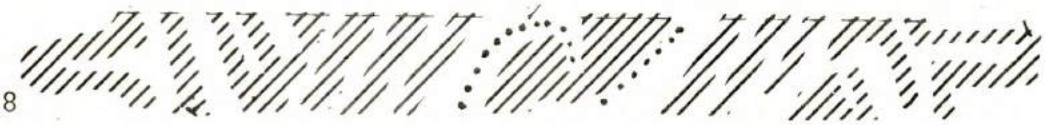
153



085

103



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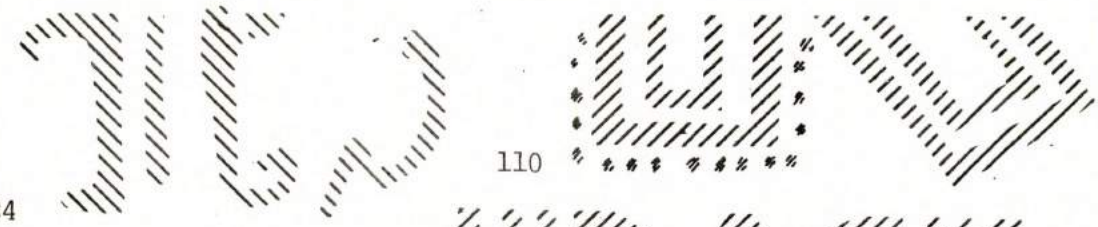

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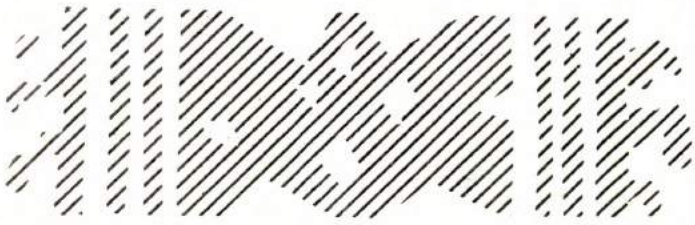
110



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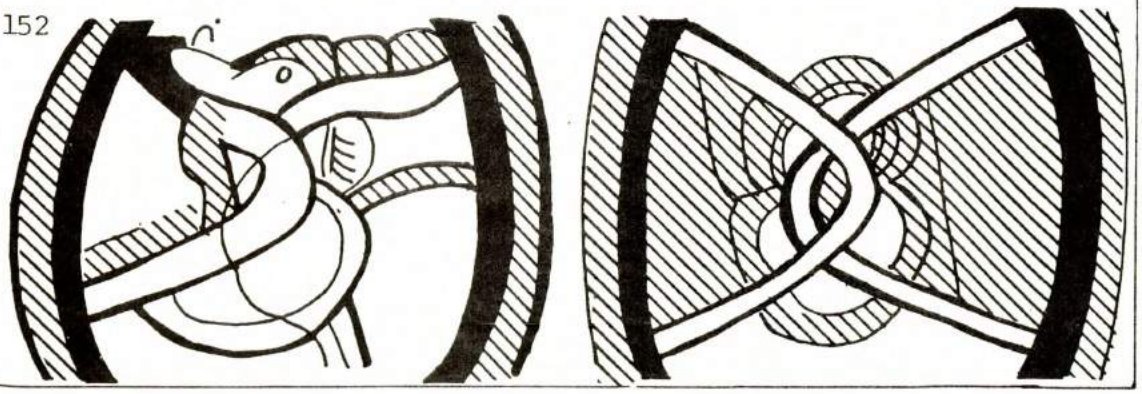
152



APPENDIX G

METHOD AND PROCEDURES USED FOR COMPUTING CONSTRUCTION COMPLEXITY INDEX

Data about the construction features of 13 tombs were recorded from Longyear's descriptions (1952: 35-49). (Six other tombs were eliminated from this analysis because data were not complete.) The following characteristics were tabulated:

1. Number of chambers (1 or 2).

2. Square footage (computed from the dimensions given; an attempt was made to compute cubic area but the height measurement was missing in too many instances). Based on the distribution of the measurements the tombs were classified as small (less than 1 sq. ft.); medium (1 to 6 sq. ft.); large (10 sq ft.). Values were assigned to these classifications (1=small; 2=small; 3= large).

3. Corbel vault. If a corbel vault was present, a value of 1 was given; no vault = 0.

4. Cut masonry. If cut masonry was present, a value of 1 was assigned; no cut masonry = 0. In two instances the investigator noted that both boulders and cut stones had been used. These cases were given 0.5 value.

5. Niches. A value of 1 was given for each nich reported.

6. Slab floor/slab roof. A value of 1 was given if a slab floor had been laid; 1 if a slab roof were present.

The procedure was to record for each tomb its value per characteristic. The values were then summed per tomb to obtain a numerical index of each tomb's constructional complexity: the higher the index, the more complex the tomb was judged to be. The distribution of the indexed tombs is given below.

Index Value	Number of tombs
3 (low)	3
3.5	1
4	1
5	3
6	3
7	1
8 (high)	1

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